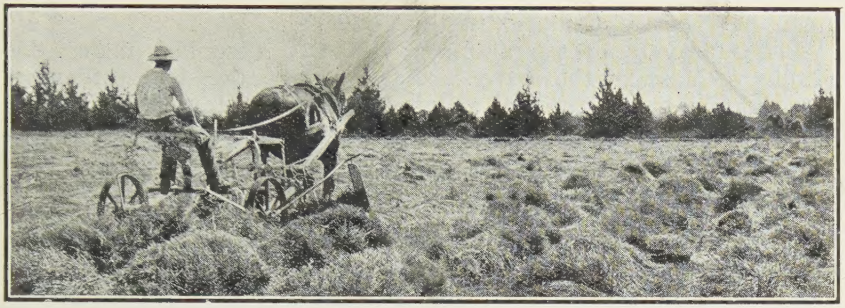

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A RECONNAISSANCE SURVEY OF PUMICE SOILS.

ROTORUA COUNTY.

(Continued.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THERE is no land in New Zealand which is so neglected in settlement as that of the pumice type. Any knowledge that can be gained which will lead to an increased utilization of pumice lands as a whole will, owing to the vast areas which are available, the low price of these, and the ease with which they may be cleared and roaded, contribute largely to the prosperity of the Dominion. But there is pumice and pumice. To the optimist, and one possibly without practical experience of the difficulties in farming the worst kinds, all pumice lands are latent with wealth and only await railways, roads, and harbours to realize a golden harvest, while to the practical pessimist who has failed on one of the difficult pumice types all kinds are anathema. Each commentator may be in a measure right, but errs in arguing generally from different premises.

It is the aim of this series of articles to classify the different types of pumice soils so that any may be recognized, and that none may suffer unjustly from evil reputation of a neighbour or prosper inequitably from a false comparison. It is not claimed that such initial investigation will resolve all difficulties; but classification is the first step to a clear understanding—that when the facts are known reason may exercise its judgment.

I. MAMAKU—*concluded.*

Before leaving consideration of the area described under the heading of Mamaku the writer would draw attention to the illustration showing the relation of the soil, subsoil, and underlying rock (Fig. 1). In this quarry at Mamaku the sharp line of demarcation between the hard rhyolitic rock and the soft pumice-gravel subsoil is well shown. The roots of the tree indicated by the remaining stump descended through the subsoil until they rested directly upon the rock, but could not penetrate it. The absence of any parting layer of soil, weathered rock, or organic matter between the rock and the gravel will be noticed. Above the yellow pumice gravel the subsoil passes imperceptibly into the mixture of partially decayed pumice and organic matter forming the soil.

A further collection of analyses of samples from the Mamaku district is given in the accompanying tables, which confirm the statement as to the uniformity of the mechanical composition of each type of soil over a large area. Some additional analyses are given of the "birch" soils, and of the cultivated and grassed soils of the Mamaku Demonstration Farm.

Fig. 2 shows a typical scene on the main Rotorua–Lichfield Road, about four miles distant from the Mamaku Farm, near Steele's old mill. Between these points the country is similar, showing great constancy to type.

II. ROTORUA BASIN.

The geological history of the lands within the Rotorua crateriform depression is more varied. They may be comprised in the following classes: (1) Lake-terraces overlain by ejected material, including (*a*) Rotorua pumice shower, (*b*) 1886 eruption mud; (2) recent lake-terraces; (3) river-terraces.

(1.) A great distinction must be made between the lands on the eastern, or Te Ngae, side of Lake Rotorua (*b*), which have been covered with calcareous mud deposits since 1886, subsequent to the Rotorua pumice shower, and those lands (*a*) which have not had the benefit of this top-dressing. This distinction makes a very great difference to the agricultural value of the lands, not only from the lime present in the mud but also from the finer nature of the material.

(2.) Recent lake-terraces are those which have been recently and are still being formed at lake-level by the subsidence of the waters, which is still taking place. In many of these there is evidence of coarse pumice having been left as beaches round the lake. The soils of these lake-level terraces differ from others in the greater water content, which is difficult to demonstrate in analyses of samples. In these almost submerged lands the water is so free and abundant that it runs out of the soil in the process of lifting the latter. It is, however, evident that the lands are often saturated with water. It is on such coarse soils, which are growing a pasture that would be deemed poor by the ordinary farmer, consisting largely of Yorkshire fog and other weeds, that bush-sick stock recover when pastured there.

Gile ("Cause of Lime-induced Chlorosis and Availability of Iron in the Soil," *Journal of Agricultural Research*, October, 1920, vol. 20, p. 34), in experiments with rice, found that, although rice becomes

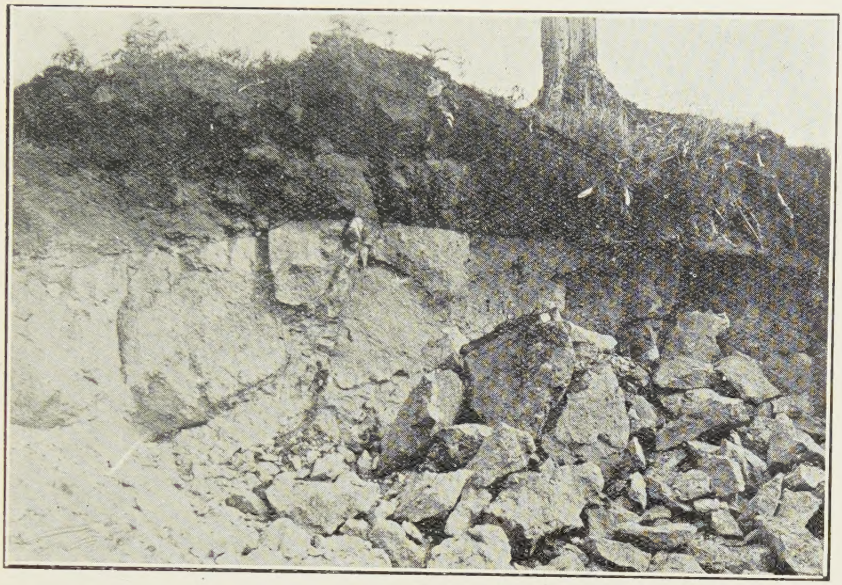


FIG. 1. SHOWING DEPOSIT OF PUMICE ON TOP OF RHYOLITE ROCK AT QUARRY NEAR MAMAKU.

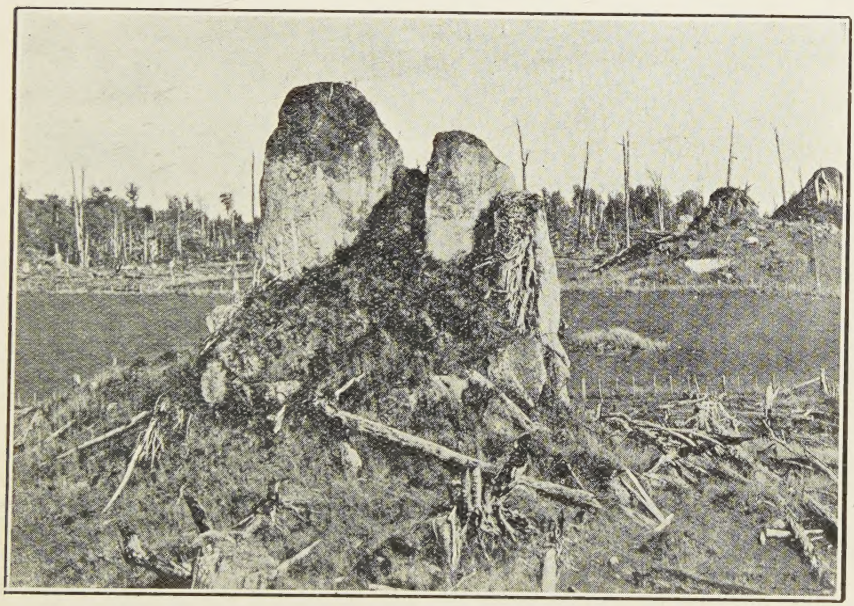


FIG. 2. TYPICAL MAMAKU PHYSIOGRAPHY ON CLEARED LAND.

Rhyolite necks or pillars at cross-roads between Mamaku and Steele's Mill.

[*All photos by B. C. Aston.*

chlorotic (free from green colouring-matter) in calcareous soils with ordinary percentages of water, it will grow normally in certain calcareous soils if the soil is submerged. Many of the Rotorua lake-side soils for a great part of the year may be so saturated with water that they can be described as nearly submerged. Chlorosis in plants is a condition which Gile attributes to a depression in the availability of iron in the soil, and he concludes that rice may be expected to make practically a normal growth if the soils are submerged. This point of view is extremely interesting as affecting bush-sick country. One may reason that as coarse pumice soil at lake-level is free from bush sickness, although derived from the same class of material as that at Mamaku, the proportion of the water in the soil is the great factor in effecting the change for the better. It is, of course, impossible to submerge the bush-sick lands, but their water-holding capacity may be increased by cultivating, compacting, and green-manuring. By such means may the pumice-particles be made to decompose and yield up their stores of plant-food—particularly iron—which are so obstinately held. As showing how readily under favourable conditions, with the aid of stagnant water and decaying plant-remains, the iron and manganese may be liberated from coarse pumice soils, the photograph, Fig. 4, may be studied. At the Railway quarry near the Rotorua Railway-station, at some quite recent date geologically, marshy conditions must have prevailed, the result being that a large amount of the iron and manganese was leached out of the first few feet of pumice and redeposited where the subsoil became much coarser. The dark nature of the underlying stratum is caused by the coating of the pumice gravel with oxides of iron (brown) and manganese (black) which have been leached out of the top soil.

(3.) River-terraces are comparatively rare, and, being of small acreage, are unimportant, but are often lands of high fertility.

NATURAL VEGETATION.

Hall and Russell (vol. 4, *Journal of Agricultural Science*) lay stress on the fact that coarseness of soil must be studied in connection with climate (particularly rainfall and temperature). Exact meteorological data for comparison of the Rotorua series of soil with the Mamaku series are, unfortunately, not available. Climatically those stations are different, Mamaku being some 800 ft. above Lake Rotorua and the temperature being lower. The rainfall may be heavier. These climatic differences may have had their effect in the great difference to be found in the natural plant covering of the two areas. At Mamaku it is all forest, but at Rotorua there is a very puzzling vegetation. With the exception of the Te Ngae lands on the east side of the lake, there is nothing like the Mamaku forest until the hill forests are reached at some 500–600 ft. above the lake. Swampy forest is developing in wet places round the lake, white-pine-pukatea forest at Te Ngae, and pure white-pine at Ngongotaha. When, however, one leaves the swampy shores only manuka or fern is encountered. Dieffenbach ("Travels in New Zealand"), in 1843, was puzzled by the curious distribution of the woods, and his solution, deduced from the presence of charred stumps, is perhaps partially true, that the great absence of forest within the Rotorua crateriform depression is due to the activity of

FIG. 3. TYPICAL "BIRCH" FOREST, MAMAKU.

Samples R 946, 1126, and 1156 are representative of this soil.

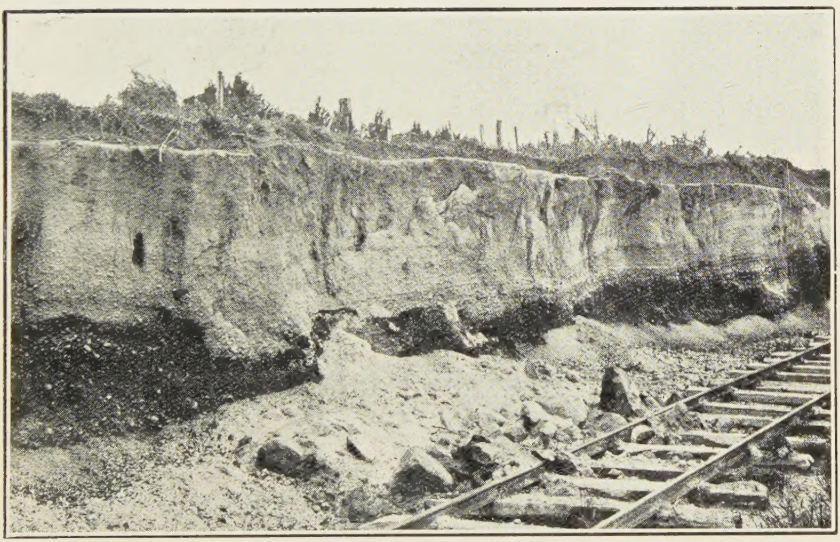


FIG. 4. SECTION OF PUMICE-GRAVEL PIT AT ROTORUA, SHOWING PAN FORMED BY LEACHING OUT OF IRON AND MANGANESE.

The dark stratum along the foot of the pit has resulted from deposition of the iron and manganese.

the Natives in clearing the country for their cultivation. A patch of rimu-tawa forest may be seen on the Te Ngae flat, but this is the only exception of dry-land forest which the writer has encountered on the lowlands, and the preservation of this may be due to the missionary influence in early years.

Fletcher (" Recent Changes in the Vegetation of the Taupo District," *Trans. N.Z. Inst.*, vol. 47, p. 70, 1914) is of opinion that the succession of the vegetation at Taupo was in the following order: Fern, tussock-scrub, forest. If this succession holds true, in Rotorua the native growth at the lower levels has only reached the scrub stage, two species of manuka (*Leptospermum scoparium* and *L. ericoides*) being the predominating shrubby plants on the lower levels, while the higher levels

FIG. 5. SWAMPY FOREST DEVELOPING AT NGONGOTAHA, NEAR ROTORUA.

Conditions here, on the lake-border, are ideal for quick growth of young white-pines. Scrub in foreground is manuka. Sample R 1147 represents this soil.

are still in the fern stage, *Pteridium esculentum* (New Zealand bracken) and *Coriaria ruscifolia* (tutu) being the predominating growth. Where thermal activity is present a variety of scrubby growth exists, and where swamp conditions occur special associations of herbaceous swamp plants are also present in fairly large areas, but these are not of agricultural importance.

The only correlation between soil and vegetation detected in the Rotorua district is the occurrence of distinct types of forest in very wet subsoil. At Ngongotaha a pure wood of young white-pine (*Podocarpus dacrydioides*) is developing almost at the lake's edge on a sandy silt (Fig. 5), and at Te Ngae, on a sandy loam in similar situation, an old pukatea (*Laurelia novae-zelandiae*) and white-pine forest has developed.

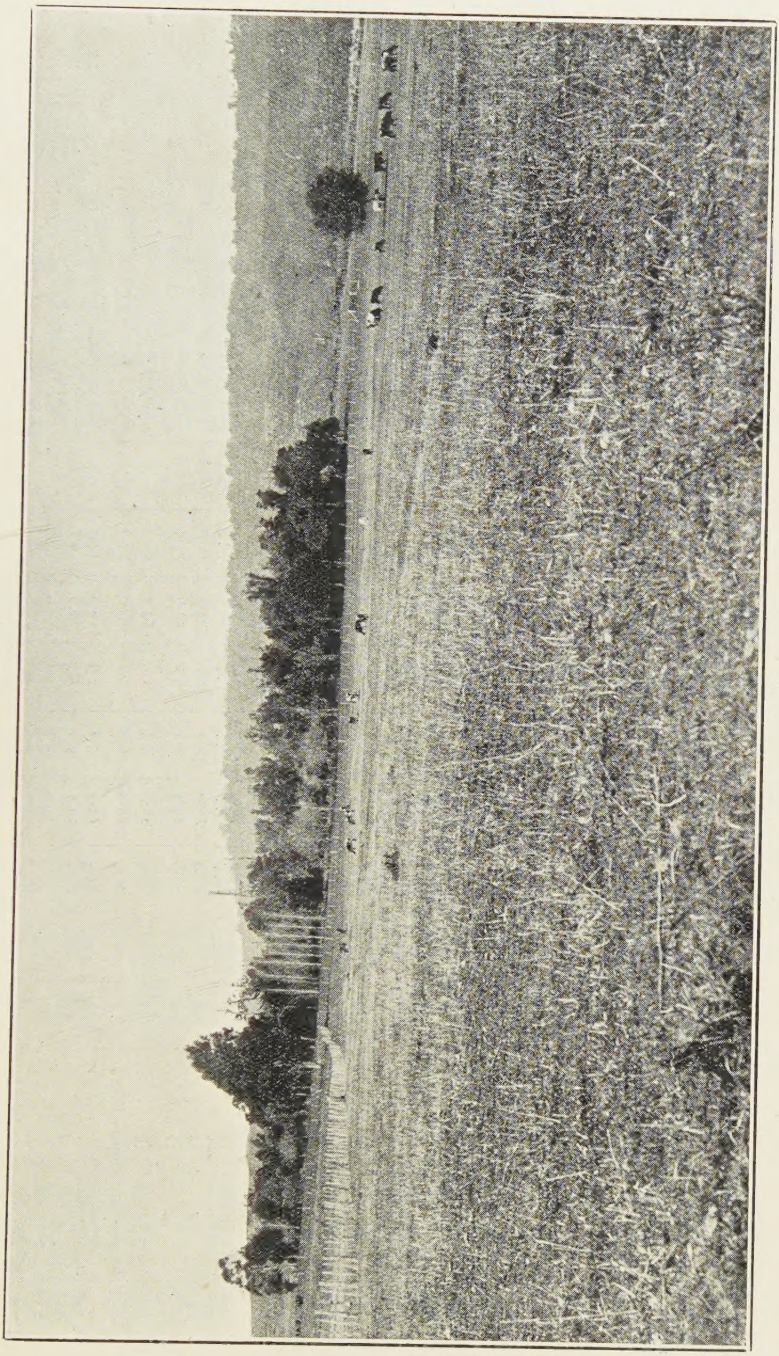


FIG. 6. TE NGAE MISSION-STATION FARM, NEAR ROTORUA.
Typical of soils D 36/5 and H 521.

TABLE 3. MECHANICAL ANALYSES.

	Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	Remarks.
			Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.		
		Mamaku: Rimu-Tawa Soils.										
S	173	Sandy silt	1·4	28·9	24·7	17·7	7·6	2·8	2·4	13·7	2·1	No. 4 paddock, cultivated flat, Demonstration Farm.
	174	,, ...	2·1	27·8	23·2	16·9	6·3	3·6	3·8	15·3	4·0	Unmanured 200-acre paddock, Demonstration Farm. Pasture.
	178	,, ...	1·8	27·8	23·3	16·1	7·8	2·3	7·6	11·9	5·3	No. 12 (spent iron oxide) paddock, Demonstration Farm. Pasture.
	180	,, ...	1·1	27·7	22·1	16·9	7·5	3·1	3·1	16·9	1·7	No. 11 (guano) paddock, Demonstration Farm. Pasture.
	181	,, ...	1·3	30·5	27·4	18·7	8·6	2·3	1·6	9·7	4·5	From rimu-tawa forest, Demonstration Farm.
	182	,, ...	1·1	30·6	26·0	17·7	8·5	1·2	3·1	11·5	3·5	From rimu-tawa forest, scenic reserve.
	183	,, ...	1·5	31·4	27·5	18·3	9·0	1·9	1·5	8·9	3·8	From windmill paddock, Demonstration Farm. Pasture.
	192	Sandy loam	1·0	17·7	16·2	11·9	9·6	7·0	9·5	26·4	Trace	From rimu-tawa forest, end of Steele's tramway, near bridge. Rhyolitic soil.
S	59	,, ...	1·2	14·7	12·4	15·5	11·3	1·8	34·0	9·5	..	From No. 9 (pig) paddock, rhyolitic mound, Demonstration Farm. Pasture.
C	825/9A	Sandy silt	1·2	27·7	22·1	19·7	8·9	2·9	3·8	12·9	..	From Martin's demonstration experiment paddock, Mamaku. Pasture.
R	986, 989	Subsoil (sandy silt) ..	0·8	28·8	26·7	13·4	5·3	3·2	5·4	15·2	..	Composite sample of subsoils from railway cutting, spent-oxide paddock, and scenic reserve, Mamaku.
S	179											
		Mamaku: "Birch" and related Soils.										
S	336	Sandy loam	1·4	14·4	17·3	17·5	6·5	3·6	25·3	14·0	4·0	Birch forest, National Timber Company's cutting.
	338	,, ...	..	..	..	..	..	..	..	..	9·5	Rimu-tawa, adjoining S 336.
	184	,, ...	1·3	12·9	16·3	15·0	11·1	2·3	31·3	9·6	6·5	Birch forest, Gamman's cutting.
H	511/513	,, ...	2·2	16·1	19·0	16·3	8·1	3·1	22·6	11·4	..	Composite Oturoa top soils
	515/517											
	512/514	Sandy silt	0·5	16·8	23·4	16·4	6·5	1·4	23·3	10·0	..	Composite Oturoa subsoils
	516/518											
S	335	Sandy silt approaching a sandy loam	1·6	19·4	21·3	18·0	6·5	2·2	14·8	13·3	4·4	Oturoa Road (near school).
	338	Sandy silt	8·2	21·7	19·3	16·2	6·7	1·8	12·9	12·5	9·5	Rimu-tawa, adjoining S 336.
	340	,, ...	1·6	28·5	21·0	18·4	9·5	1·4	10·9	8·7	6·6	Birch ridge, back of Ngongotaha, 850 ft. (Not typical birch country.)

Rotorua: Lake-level Soils.

R	887	Sandy silt	..	..	7·3	31·0	21·4	14·1	11·4	3·6	2·0	8·7	7·2	Hinemoa Point, east side. Rough pasture.
	879	Coarse sand	..	..	8·8	38·1	22·7	8·3	6·3	2·2	1·8	12·6	17·1	Ngongotaha, lake-side. Rough pasture.
	1147	Sandy silt	..	..	8·5	32·5	16·5	14·1	10·4	2·0	2·9	15·1	9·1	White-pine forest, lake-side. Ngongotaha.
H	840	Coarse sand	..	..	16·8	45·6	17·9	8·3	2·3	1·2	7·6	..	20·0	Lake-side, Rotorua. Pasture.
	482	„	..	..	17·6	41·7	12·8	15·0	3·5	1·2	8·1	..	24·1	Lake-side, Wairangi East. Pasture.

Rotorua: First Terraces above Lake.

H	493	Sandy silt	..	..	2·1	21·1	18·1	15·9	3·1	1·3	25·7	12·1	4·1	Clayton Road, near Fairy Spring. Manuka.
	495	„	..	..	1·1	14·2	28·2	15·6	3·5	1·4	24·2	11·2	6·9	Clayton Road, wet soil. Manuka.
R	877	„	..	..	4·3	33·8	21·6	15·6	6·9	1·6	2·1	12·3	Trace	Clayton Road, poor pasture.
	979	„	..	..	2·6	31·3	23·9	18·5	6·2	0·9	2·5	12·0	Trace	50 ft. terrace. Pasture.
	1149	Sandy loam	..	..	1·3	18·7	21·1	23·9	11·0	3·8	3·7	16·3	Trace	River-terrace. Pasture.
	1093	Sandy silt	..	..	3·3	29·3	25·1	20·5	5·4	1·1	2·4	11·5	Trace	Arapeeti Reserve, Whakarewarewa Stock Road. Manuka.

Rotorua: Upper Lake Terraces.

P	531	Sandy silt	..	..	0·8	23·7	28·7	21·1	8·1	1·4	..	14·7	..	Malfroy Road.
R	949	„	..	..	2·5	28·9	25·0	18·3	7·1	1·0	2·6	12·7	Trace	Malfroy Road. Manuka terrace.
	952	„	..	..	2·2	29·1	24·5	18·3	5·2	0·9	5·9	12·3	„	Malfroy Road. Cultivated.
	955	„	..	..	2·3	27·6	26·7	18·9	6·6	0·8	2·2	13·0	4·5	South of 952, towards Whakarewarewa.
	958	„	..	..	2·5	27·6	23·2	16·8	5·3	0·7	10·9	13·3	Trace	Slopes of terrace 100 ft. above Rotorua. Fern.
	982	„	..	..	3·0	33·7	23·9	16·7	5·7	0·7	2·9	11·8	„	Ngongotaha terraces, 200 ft. Pasture.
	991	„	..	..	3·1	36·4	20·3	12·7	4·9	0·6	6·4	14·7	„	Ngongotaha hillside above top terrace. Fern.
	967	„	..	..	2·3	29·0	23·7	20·0	6·4	1·1	2·9	12·8	4·5	Above Ngongotaha Township 175 ft. Terrace. Pasture.
	869	„	..	..	2·1	25·4	26·1	18·8	6·2	0·8	4·1	15·4	4·0	Highest terrace in tutu and fern association.
	871	„	..	..	2·7	27·5	21·7	18·7	7·2	1·0	5·7	14·1	2·7	Grassed land going back to fern. Hillside terrace.
	873	„	..	..	2·5	30·6	22·5	19·3	6·5	1·3	2·6	13·0	3·0	Excellent pasture paddock. Lowest terrace.
	875	„	..	..	2·9	29·0	22·2	19·5	6·5	0·8	2·9	15·4	Trace	Fern land, upper Clayton Road. Not terraced, 475 ft.
	961	„	..	..	2·0	29·3	23·4	17·8	5·8	1·6	2·5	16·4	3·0	Hillside soil to south of R 875. Fern.
	950	„	(subsoil)	..	2·8	39·5	21·8	17·7	5·7	1·2	2·0	7·6	Trace	Subsoil of R 949.
	964	„	..	..	2·6	23·8	25·1	22·8	9·6	1·7	1·5	11·1	Trace	Upper Ngongotaha River terrace, 200 ft.

NOTE.—The exact similarity of the hillside soils to the terraced soils shows that the terraces have been covered by an aerial deposit since they were formed.

Rotorua: East Side, influenced by 1886 Eruption Mud.

R	1102	Sandy silt	..	..	4·8	28·9	24·6	22·1	5·1	1·5	2·0	10·1	Trace	Wairoa Road, lowest paddocks cultivated. Slight mud layer.
	881	Coarse sandy silt		..	14·2	35·7	17·8	12·9	7·7	2·6	1·6	6·9	24·3	Mourea hillside. Tutu and fern.
	1096	Sandy loam	..	..	6·1	18·3	26·6	18·7	13·4	5·5	2·2	9·7	5·5	Wairoa Road, 135 ft. Cultivated from tutu and fern.
	1099	„	..	..	5·9	21·7	30·0	22·7	7·9	4·6	1·1	5·4	4·4	Wairoa Road, 320 ft. Cultivated.
	885	„	..	..	4·8	21·8	28·1	21·2	9·4	5·1	1·4	7·2	10·9	Wairoa Road. Cultivated. Clover.
H	519	„	..	..	1·9	10·1	22·5	38·6	7·1	5·0	..	15·3	8·6	Te Ngae swampy forest (pukatea-kahikatea).
	521	„	..	..	4·4	22·4	20·5	20·1	6·5	5·8	..	20·5	Nil	Te Ngae volcanic mud.
R	883	„	..	..	9·4	30·4	23·5	15·9	9·5	4·4	0·9	5·4	19·0	Te Ngae river-terrace.
H	520	Sandy silt	..	..	10·6	15·9	12·8	12·4	7·6	2·7	30·0	8·0	..	Subsoil of H/519.

TABLE 4. CHEMICAL ANALYSES.

Results, except *, are percentages on soil dried at 100° C.

Laboratory No.		Locality.	Volatile Matter.			Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Hydrogen-ion Determination. pH Value.	Fe (Iron).	
			* On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.		Extracted by Citric Acid.	Extracted by HCl.
		Mamaku: Rimu-Tawa Soils.															
		Taken at or adjoining Demonstration Farm.															
S	173	No. 4 (cultivated) paddock	..	2·42	14·04	0·287	0·145	0·014	0·014	0·011	0·22	0·13	0·08	0·02	5·7	0·118	..
	174	200-acre grassed paddock	..	3·80	15·28	0·314	0·028	0·007	0·008	0·003	0·20	0·16	0·04	0·05	5·6	0·073	..
	175	200-acre grassed paddock	..	32·00	12·15	0·322	0·195	0·019	0·020	0·003	0·45	0·15	0·07	0·02	5·6	0·049	..
	176	Eruption dust	..	0·82	5·48	0·119	0·036	0·014	0·013	Trace	0·13	0·11	0·04	Trace	5·8	0·022	..
	177	Rhyolite mound, No. 6 paddock ..	..	4·78	10·67	0·232	0·167	0·017	0·009	0·006	0·23	0·13	0·05	0·02	5·7	0·062	..
	178	Spent-oxide paddock, No. 12 ..	..	7·64	12·91	0·385	0·132	0·019	0·023	0·005	0·22	0·15	0·06	0·03	5·4	0·075	..
	179	Subsoil of No. 178..	..	5·82	13·82	0·241	0·061	0·009	0·008	0·004	0·12	0·10	0·04	0·02	5·8	0·066	..
	180	Guano paddock, No. 11	..	2·96	17·33	0·413	0·173	0·019	0·024	0·006	0·29	0·15	0·07	0·03	5·9	0·116	..
	181	Rimu-tawa forest	..	1·64	9·92	0·222	0·120	0·032	0·015	0·004	0·44	0·15	0·07	0·01	5·6	0·072	..
	182	Rimu-tawa scenic reserve	..	3·12	11·54	0·301	0·111	0·030	0·013	0·005	0·24	0·12	0·04	0·01	4·6	0·057	..
	183	Windmill paddock, No. 6	..	1·46	8·99	0·230	0·135	0·015	0·020	0·005	0·24	0·13	0·06	0·02	5·5	0·100	..
	192	Steele's new tram, near bridge ..	..	9·52	29·13	0·684	0·192	0·023	0·025	0·010	0·35	0·14	0·08	0·05	5·0	0·071	..
		Mamaku: "Birch" Soils.															
S	184	Birch forest, Gamman's cutting ..	..	31·21	13·97	0·248	0·038	0·014	0·016	0·002	0·15	0·14	0·05	0·01	4·4	0·098	..
	185	Subsoil of 184	..	7·72	11·64	0·176	0·022	0·005	0·006	0·001	0·14	0·16	0·08	0·01	5·9	0·112	..
	336	Birch forest, National Timber Company's cutting	29	25·26	17·34	0·322	0·045	0·011	0·011	0·003	0·17	0·13	0·11	0·01	..	0·090	..
	338	Mixed forest, National Timber Company's cutting	30	12·94	14·36	0·357	0·087	0·015	0·017	0·005	0·28	0·17	0·16	0·05	..	0·057	..
	335	Oturoa Road, near school	25	14·82	15·75	0·381	0·155	0·021	0·024	0·007	0·33	0·20	0·09	0·03	..	0·069	..
		Rotorua: Lake-level Soils (swampy).															
D	348/5/6	Ngongotaha	..	35·84	10·34	..	0·158	..	0·013	0·011	0·445	..	..	0·12	..	0·102	0·81
R	879	"	..	35·20	6·68	..	0·045	..	0·009	0·007	0·204	..	..	0·10	..	0·129	0·85
	887	Hinemoa Point (not swampy) ..	39	1·81	12·85	0·393	0·157	0·020	0·033	0·019	0·440	0·130	0·09	0·09	5·5	0·086	..
	1147	Ngongotaha white-pine swamp ..	22	2·02	8·88	0·251	0·080	0·036	0·027	0·013	0·620	0·280	0·18	0·05	5·8	0·051	..
			31	2·87	15·56	0·386	0·108	0·036	0·023	0·019	0·440	0·210	0·14	0·15	5·5	0·163	..

Rotorua: First Terrace above Lake.

R	877	Clayton Road	27	2·10	12·50	0·243	0·054	0·020	0·018	0·006	0·23	0·13	0·03	0·05	6·0	0·029	..
	979	Ngongotaha, 50 ft.	23	2·53	11·72	0·279	0·112	0·027	0·009	0·005	0·31	0·12	0·04	0·11	6·4	0·015	..
	1093	Arapeeti Reserve, 80 ft.	21	2·39	11·33	0·227	0·013	0·018	0·013	0·006	0·26	0·23	0·37	0·09	..	0·024	..

Rotorua: Upper Lake Terraces.

P	531	Malfroy Road Settlement, Rotorua		3·16	13·22	0·208	0·086	0·022	0·019	0·003	0·24	0·20	0·09	0·02	..	..	..
R	949	Malfroy Road Settlement, 50 ft. ..	34	2·60	13·05	0·293	0·062	0·017	0·019	0·011	0·18	0·15	0·11	0·06	6·5	0·046	..
	952	Malfroy Road Settlement, middle terrace, 450 ft.	25	5·90	13·04	0·253	0·058	0·027	0·018	0·007	0·20	0·19	0·08	0·09	6·5	0·033	..
	955	Malfroy Road Settlement, 425 ft. ..	35	2·76	12·77	0·265	0·100	0·040	0·015	0·005	0·20	0·12	0·01	0·10	6·3	0·028	..
	958	Malfroy Road Settlement, fern slopes, 100 ft.	26	10·86	14·60	0·270	0·070	0·031	0·017	0·009	0·15	0·11	0·05	0·10	6·5	0·029	..
	982	Mount Ngongotaha, 200 ft. terrace ..	23	2·90	12·14	0·257	0·085	0·026	0·022	0·006	0·34	0·23	0·09	0·11	6·6	0·015	..
	991	Mount Ngongotaha, hillside ..	20	6·44	13·91	0·296	0·101	0·028	0·021	0·005	0·28	0·15	0·07	0·05	..	0·015	..
	967	Mount Ngongotaha, 175–200 ft. above township	29	2·88	13·17	0·293	0·085	0·023	0·017	0·005	0·23	0·17	0·05	0·02	6·2	0·021	..
	869	Malfroy Road Settlement, highest terrace	30	4·74	16·00	0·356	0·144	0·024	0·026	0·011	0·48	0·19	0·08	0·02	6·3	0·064	..
	871	Malfroy Road Settlement, middle terrace	29	5·66	15·09	0·279	0·131	0·037	0·028	0·012	0·33	0·16	0·07	0·06	..	0·052	..
	873	Malfroy Road Settlement, lowest terrace	31	2·60	13·30	0·282	0·081	0·034	0·018	0·006	0·22	0·14	0·05	0·04	6·3	0·053	..
	875	Upper Clayton Road, 475 ft. ..	38	2·86	15·80	0·300	0·129	0·042	0·031	0·006	0·36	0·18	0·07	0·07	6·2	0·052	..
	961	Upper Clayton Road, 475 ft.		2·46	16·85	0·304	0·058	0·023	0·010	0·006	0·20	0·19	0·03	0·04	..	0·035	..
D	1121/5	Whakarewarewa (green-manured)		19·09	10·43	0·193	..	..	0·028	0·017	0·36	0·12	0·06	0·13	..	0·031	..
	1121/3	Whakarewarewa (green-manured)		32·80	11·69	0·225	..	..	0·019	0·024	0·37	0·10	0·06	0·11	..	0·034	..
	1121/4	Whakarewarewa		33·03	10·52	0·179	..	..	0·014	0·013	0·21	0·08	0·05	0·04	..	0·045	..

P 531: Lime-requirement—on air-dried soil, 0·37; on soil dried at 100° C. 0·38.

Rotorua: East Side, influenced by 1886 Eruption Mud.

R	1102	Wairoa Road, low level	17	1·98	9·93	0·197	0·068	0·027	0·017	0·007	0·48	0·26	0·14	0·08	..	0·018	..
	881	Mourea Village	28	1·58	7·03	0·156	0·093	0·028	0·030	0·012	0·82	0·42	0·17	0·03	5·9	0·085	..
	1096	Wairoa Road, higher level ..	10	2·22	10·37	0·247	0·262	0·048	0·035	0·011	0·67	1·04	0·47	0·04	..	0·055	..
	1099	Wairoa Road, highest level ..	15	1·08	5·17	0·142	0·136	0·045	0·035	0·009	2·10	1·08	0·47	0·05	..	0·054	..
	885	Wairoa Road, low level	31	1·44	7·32	0·153	0·128	0·034	0·023	0·005	1·25	0·6	0·24	0·03	6·5	0·032	..
D	36/6	Wairoa Road (tutu and fern) ..	..	25·65	5·44	..	0·146	..	0·024	0·031	..	..	..	0·08	..	0·184	1·510
	36/7	Wairoa Road	..	13 30	2·36	..	0·153	..	0·035	0·043	..	..	..	0·06	..	0·304	1·950
H	519	Te Ngae, swampy forest, lake-level..	..	13·10	4·75	0·129	0·119	0·010	0·013	0·025	1·29	0·38	0·02	0·07	..	0·129	..
R	883	Te Ngae, river-terrace	15	0·90	5·40	0·161	0·101	0·034	0·025	0·006	1·17	0·64	0·23	0·03	6·0	0·031	..
C	1317/4A	Te Ngae, 1886 eruption mud ..	..	24·27	4·67	..	0·186	..	0·016	0·044	..	..	..	0·09	..	0·135	1·52
D	36/5	Te Ngae, low-level paddocks ..	..	21·25	5·36	..	0·192	..	0·017	0·047	..	..	..	0·09	..	0·240	1·42
	1121/13	Te Ngae, white-pine swamps ..	..	23·89	3·51	0·066	..	..	0·020	0·025	2·05	0·76	0·11	0·05	..	0·178	0·80
	1121/14	Te Ngae, fern country, low level ..	..	17·76	3·09	0·096	..	..	0·023	0·022	1·74	0·86	0·27	0·05	..	0·101	1·598
	1121/15	Te Ngae, subsoil of 14	..	21·11	9·99	0·188	..	..	0·037	0·011	0·05	0·32	0·13	0·07	..	0·108	1·215
	1121/16	Te Ngae, raupo swamp	..	28·56	20·15	0·381	..	..	0·043	0·063	1·25	0·46	0·21	0·20	..	0·431	..

NOTES.—Sample R 887 (Rotorua lake-level soils) bears only slight evidence of having been affected by the 1886 eruption mud (see lime percentage). Series D 1121/3/4/5 are inserted to show the effect of ploughing in green crops at Forest Department's nursery. Series R 949/52/55/58 is taken to the east of series R 869/71/73/75, but on the same terraces approximately.

CONCLUSIONS.

The results of analyses of typical Mamaku and Rotorua sandy silts show that they are all soils of excessively coarse texture, but that the Rotorua lake-side sandy soils are superior in water and available iron and phosphoric-acid content. The other Rotorua sandy silts have a higher hydrogen-ion figure (*i.e.*, a less acidity) than the Mamaku series, but the available and total phosphoric acid is still low enough to be regarded as deficient. The sandy loams of Rotorua are pre-eminently fertile and healthy soils. The percentage of lime (CaO) extracted by strong acid solvents is exceptionally high. This constituent probably exerts a beneficial effect in keeping the other plant-foods available. These sandy loams cannot be judged by the same standards as those applied to the sandy silts. The amount of available and total iron present is high.

A comparison of the figures given by the Rotorua and Mamaku sandy silts suggests that there is little chemical or physical difference between them. The matter must, however, be studied in connection with the climate, which may differ widely in the two districts, Mamaku being some 800 ft. above these Rotorua terraces. No meteorological records are, however, available for Mamaku. Rotorua (rainfall 40–60 in. annually) may have the advantage in climate, but this is not certain, as a greater rainfall and lower soil-temperature — conditions which may be safely credited to Mamaku—may be more beneficial to the accretion of humus in sandy silts than lower rainfall and higher temperature. Rotorua certainly has the advantage in the fact that the country has been cleared of forest by the aboriginal owners, and the lands have not had time to revert to a vegetation more woody than that of the fern or scrub stage. Hence the matter of clearing, cropping, and grassing Rotorua fern and scrub lands is a cheap and simple matter compared with breaking in the forest country of Mamaku.

Whether the same standard for iron should be applied to judge the Rotorua sandy silts as the Mamaku sandy silts is a matter which is better deferred until the other pumice series of the adjacent country are examined.

One can at present only say that these analyses emphasize the advice already given to increase the humus content and therefore the water-supply of the soil by green-manuring, and the mineral-food supply by phosphate manuring, which also increases the root-development of the plant and enables a wider area of soil to be penetrated for plant-food. Lime should not be used on sandy silts except for such crops as turnips.

All the samples taken in this survey were drawn under the writer's personal supervision in the field. The soils were taken from cultivated or grassed areas or areas under the native vegetation. They were drawn by means of a sample auger to a uniform depth of 9 in., the subsoil being taken to a further depth of 9 in. below this, and occasionally a second subsoil was taken 9 in. below the first subsoil. Several cores were taken and mixed together to represent the final sample. When present a full note of the native vegetation was taken. As before, Mr. L. D. Foster and Mr. R. E. Grimmett are responsible for the laboratory work.

IRRIGATION AND ITS PRACTICE.

(Continued.)

VI. LUCERNE-GROWING UNDER IRRIGATION.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin, and J. R. MARKS, A.M.Inst.C.E., M.N.Z.Soc.C.E., District Engineer, Public Works Department, Dunedin.

CENTRAL OTAGO AND LUCERNE.

On account of its adaptability to the mica-schist soils of Central Otago lucerne has become the main irrigated crop in that district. Under irrigation, yields of 5 tons of hay per acre for the season are regularly obtained, and no great difficulty is experienced in establishing the crop. When its permanency is taken into consideration—some stands even now growing luxuriantly and yielding heavily after fifteen years' occupation of the same piece of ground — the cost of establishment must be considered quite moderate. A satisfactory feature of lucerne-growing in that semi-arid region is the fact that haymaking operations can be carried out expeditiously and with great certainty of favourable weather conditions being maintained during the process.

The importance of lucerne to the Central Otago irrigation-farmer well warrants a short account of the procedure most suited to growing the crop in that region. No attempt at a detailed description of the history of the crop and the numerous modifications of the general method here described will be attempted. Each farmer must realize that certain modifications will be required to suit his particular conditions, for even in such a comparatively limited area as is embraced by this series of articles there exist considerable variations in regard to soil and climatic factors.

SOILS ADAPTED FOR LUCERNE.

As has already been indicated, the bulk of Central Otago soils are well adapted for growing lucerne. Particularly is this so in the case of the deep alluvial deposits of mica-schist, which, overlying gravelly subsoils, make soil conditions ideal for this crop. The lighter admixtures of gravel and schist soils which exist in fairly large areas are also well adapted for the growth of lucerne, provided more frequent irrigations are given during the growing-period, and care taken to obtain suitably moist conditions for its establishment. To the uninitiated these lighter types of gravelly soils would appear to be hungry and unproductive, yet, given cultivation, moisture, and seed, striking results will in almost every case be obtained, the land previously covered with scabweed (*Raoulia*) being quickly transformed into luxuriant fields of lucerne.

Certain soils in Central Otago have a subsoil of a heavy clay nature, where free natural drainage does not exist to the degree required by lucerne. Such soils, unless drained, cannot be expected to grow good lucerne crops, the common experience of farmers being the failure of the crop after a short period. It is a recognized fact

that lucerne requires much more complete drainage of the soil than do other field-crops. Fortunately, only a comparatively small acreage of such soil exists in Central Otago, and where such is the case farmers will be well advised to establish permanent pasture in preference to lucerne. It is perhaps opportune to here mention that waterlogging of the soil through deficient under-drainage or over-irrigation rapidly leads to the destruction of lucerne. Seepage from water-races should therefore be looked to and prevented, particularly during the winter months.

Lucerne thrives best in a non-acid soil, and in its establishment lime is frequently applied to bring about such a condition. Generally speaking, the necessity for liming does not exist at present in Central Otago, and unless a farmer knows that his soil has a high lime-requirement there will in all probability be little need to carry out this operation. The application of lime, however, may be regarded as highly beneficial in general, and, where economic conditions permit of it, a dressing of approximately 1 ton per acre of carbonate of lime (raw ground limestone) is advised.

PREPARATION OF THE LAND.

On account of the smallness of lucerne-seed and the tender nature of the young plant a fine firm seed-bed is advocated. It is generally advisable to select, if possible, a piece of land which is comparatively free from weeds, or land which has grown a cleaning-crop during the preceding season. Such land is best put under the plough during the autumn, so that it will be open to the beneficial effects of the winter frosts. If ploughing is delayed later the ground may become too hard to plough satisfactorily. Deep ploughing is advised, provided too much gravel is not brought to the surface. Where only a thin layer of schist soil exists skim-ploughing should be resorted to. The land should be well worked up in the spring with a view to obtaining a fine seed-bed and preventing weed-growth. This may necessitate cross-ploughing, a double cut with disk cultivators, and double harrowing.

Too great emphasis cannot be laid on the desirability of carrying out the proper levelling of the surface of the land prior to sowing. How this is accomplished has already been described in a previous article, and it will be to the farmer's interest to put this recommendation into practice. The permanency of the lucerne crop well merits careful preparation of the land, and of all the operations which go to constitute this none will prove more economical than that of levelling. High dry spots and low oversaturated ones will thus be eliminated, and the field will be more evenly and more expeditiously irrigated. It is of importance that the preparation should be uniformly good, as poorly prepared portions are subject to failure. Such bare places form centres from which weeds may spread, particularly grasses, and these may ultimately destroy the whole stand.

TIME OF SOWING.

The months of November, December, or January are probably the most suitable for sowing lucerne. When it is sown early in the spring weeds prove extremely troublesome, particularly fat-hen

(*Chenopodium album*) and sorrel. It is of decided advantage to delay sowing until the first crop of spring weeds has germinated and has eventually been killed by cultivation. Fat-hen is not to be regarded as a very serious weed in lucerne stands in Central Otago, provided it is not too thick while the crop is in its young stage; it disappears with the cutting of the lucerne. By delaying the sowing until at least November, and keeping the ground well cultivated periodically, this trouble will be greatly diminished.

When lucerne is sown in the autumn the young plants are liable to be badly damaged by the ground "lifting" during the frosty winter months; consequently autumn sowing is not recommended.

SELECTION OF SEED.

Under no circumstances should cheap seed be sown. Such seed is likely to contain a high percentage of harmful weed impurities, and is in addition liable to be of poor germinating-power. The best seed possible should be obtained, and fresh season's seed asked for. There are many varieties of lucerne-seed on the market, but for Central Otago conditions the writers are satisfied that New-Zealand-grown Marlborough seed is very satisfactory, and consequently this variety is recommended. Much has been heard lately of the Grimm variety, but there appears to be no sound reason why this should be sown in preference to Marlborough, particularly when its price is more than double that of the latter. The main characteristic which has made Grimm's lucerne largely grown in certain parts of the United States is its capability of living through severe winters; but winter killing of lucerne does not concern us in this country. One looks forward to the production of lucerne-seed in Central Otago itself in the course of the next few years, and when such takes place locally grown seed should undoubtedly be used for the establishment of new crops.

METHODS OF SOWING.

The manner of sowing the seed will vary according to the implements at the disposal of the farmer. One thing, however, is of great importance. If the soil has not sufficient moisture to germinate the seed and allow the young plant to grow to about 4 in. in height a preliminary irrigation should be given before sowing. Irrigating after sowing is bad practice and results in the caking of the soil, with consequent poor germination.

The best method of sowing is by the ordinary grain-drill with a lucerne-seed attachment. Failing this, the seed may be sown through the manure-spout of the ordinary drill, by setting the drill to sow, say, 1 cwt. of manure, mixing the seed with 1 cwt. of basic superphosphate, and so conveying the correct mixture of manure and seed to the soil. By this method successful stands of lucerne were obtained at the Galloway Irrigation Farm. Where the drill is used great care should be taken not to sow the seed too deeply. The depth will depend somewhat on the character of the soil. Covering to ½ in. on the heavier types of soil is usually ample, but on the lighter types, which are likely to dry out quickly, up to 1 in. is desirable. The seed should be sown at the rate of not more than 15 lb. per acre. Many quite thick stands have been obtained from sowings of as low as

10 lb., but to be on the safe side from 12 lb. to 15 lb. is advocated. The average farmer is inclined to sow lucerne-seed too deeply, which means that much of the seed sown is lost, and unless special care is taken it is well to look upon a 15 lb. seeding as the standard. The practice at Galloway is 12 lb. per acre.

Where a drill is not available, sowing can be carried out in several ways, the chief among which are the use of the "hurdy-gurdy," the "fiddle," the wheelbarrow seeder, or the hand method. Where any of these methods are adopted it is usually advisable to sow half the seed one way across the field and the other half at right angles to the line of the first sowing. The seed should then be covered with a light harrow. Probably the best harrow for this purpose is a home-made one constructed by lacing together a few long strips of wire netting side by side, attaching them to a light drawbar, and fastening a few bolts to the end of the strips. A brush harrow made of manuka or wild-irishman is also quite suitable. If the soil is inclined to be too loose it may be rolled with a light roller, although this is not generally desirable. Before sowing seed broadcast it is usually good practice to roll the field with a Cambridge roller. This firms the soil, leaves the surface rough, and makes it possible to cover the seed well by cross-harrowing.

Under irrigation conditions the sowing of lucerne in wide drills of 21 in. or 14 in. apart, as is sometimes advocated, is not recommended; it allows too much room for the intrusion of grass and other weeds, and exposes too much soil-surface to the sun and wind, causing great loss by evaporation. The intertillage of lucerne sown in this manner is an expensive and ever-recurring operation, and in view of the excellent results obtained by sowing through every coulter of the drill or broadcast there appears to be no advantage in doing otherwise with regard to irrigated lucerne.

INOCULATION.

In Central Otago, with few exceptions, artificial inoculation of the soil is unnecessary for the successful growth of lucerne. In certain localities where difficulty has been experienced in establishing a stand it is probably advisable to inoculate before sowing, but the general experience where lucerne has been growing for a number of years with every success is that inoculation is a useless expense.

There are two general methods of inoculating soil. The first and cheapest consists of spreading soil from an old and well-established field at the rate of 2 cwt. per acre. Provided the soil is not exposed to the sunlight for a length of time, nor allowed to dry, good results will probably be obtained by this method. A cloudy day is most suitable, and the soil should be harrowed in immediately after it is spread. The second method is that of using cultures for inoculating the seed. The culture is usually contained in a special bottle, and when used according to the directions the seed is inoculated with the organisms.

In certain parts of the Dominion soil-inoculation appears to be quite necessary to ensure the successful establishment of a lucerne stand. Probably, then, where inoculation does not mean much labour or expense it would be advantageous to take this precaution prior to

FIG. 56. STAND OF IRRIGATED LUCERNE AT TARRAS, CENTRAL OTAGO.

FIG. 57. ANOTHER CENTRAL OTAGO IRRIGATED STAND, AT ARDGOUR.

sowing, and thus eliminate at least one potential cause of failure when establishing stands in localities where lucerne has not been tried previously.

IRRIGATION OF LUCERNE.

The secret of successful lucerne-growing is to so regulate the number of irrigations given to the crop that at no time will the plant's growth be checked through loss of moisture. The chief considerations affecting the time of irrigation are appearance of the crop, weather conditions and evaporation, soil moisture-content, and water-supply. When the lighter portions of the field show the least sign of wilting or yellowing of the leaf it is at once an indication that irrigation is required. The moisture content of the field should be maintained in such a condition that this wilting-point will not be reached.

Generally speaking, in Central Otago a spring crop of lucerne does not require irrigation. The subsequent crops will require quite a number of irrigations, depending upon the rainfall experienced. Of all crops few respond to such a degree in direct ratio to the water supplied as does lucerne. This may be appreciated when one bears in mind the rapidity with which the plant grows, the number of cuttings produced in the one season, and the heavy green weight obtained.

It must not be assumed that incessant pouring on of water is a desirable way in which to supply the plant with moisture. In Central Otago to-day one too often sees water being applied far in excess of the needs of the crop. It is quite a common practice there to use anything from five to seven acre-feet of water during the irrigation period. Such quantities are quite unnecessary, and, in point of fact, may prove in some circumstances injurious. Until definite water-requirements for lucerne in Central Otago have been ascertained it can be assumed as a working basis, from the results of experiments elsewhere, that the maximum amount of water which should be applied during the season is in the vicinity of 30 in., although no doubt excellent results will be obtained with a lesser quantity.

Experiments conducted at the Werribee State Research Farm, Victoria, indicated that up to a limit of 48 in. of water, in addition to 16 in. of rainfall, the yield of lucerne varied directly but not proportionately to the water applied. Results obtained by the Montana Experiment Station showed that in localities having an annual rainfall of about 12 in. remarkably heavy yields could be obtained from the use of from 24 in. to 30 in. of irrigation-water, provided it was applied properly. From information collected by the Oregon Experiment Station it was ascertained that in the chief irrigated valleys of that State, where the average rainfall was 11.15 in. and the irrigation-water applied was 33·3 in., the yield of lucerne hay amounted to 5·63 tons per acre. On quite a large area of Central Otago soils, on account of the free under-drainage, it is practically impossible to irrigate lucerne to the point where decrease in yield occurs; still, once a reasonable amount of water has been reached, the proportion of increase is very slight.

The use of water, like the use of fertilizers, is subject to the law of diminishing returns. The frequency of applications to the crop will largely be regulated by the water-holding capacity of the soil. On the light soils six to eight applications of 4 in. in depth throughout

the season might be necessary. On the more retentive soils four to five applications of 6 in. at each application would probably suffice. Generally speaking, it will be necessary to irrigate from every fourteen to twenty-one days. The period of time between irrigations will be entirely dependent upon the appearance of the crop or the condition of the soil. The chief object is to maintain at all times as nearly as practicable the proper amount of moisture in the soil surrounding the roots of the plants, so as to prevent checking of growth.

The question naturally arises as to the advisability of irrigating before cutting or after cutting. Experiments in this connection show little difference; both cutting and irrigating check the growth of lucerne temporarily. If an irrigation can be given when the plant shades the ground and begins to bloom it will produce the second crop earlier. If it is decided to irrigate before cutting, this operation must be conducted several days before, in order to allow of harvesting operations. It is often asserted that irrigation prior to cutting leaves the ground in a damp condition and thus detrimentally affects the hay, in addition to lengthening the haymaking-period. That the latter drawback to this practice is quite feasible is recognized, and, quite apart from other considerations, the increasing difficulty of obtaining labour for harvesting makes it essential when once the crop is cut to have it in the stack with as little delay as possible. It must, however, be taken into consideration that if irrigation is to take place after cutting the crop must be cut on the early side, so that no loss of leaf may occur. When the crop is in the flowering stage the rate of transpiration is high. This, coupled with the low moisture content of the soil which usually prevails at that time, soon accounts for the dying-off of a large number of leaves and consequent lessening of the value of the crop. By leaving the irrigation until after cutting the danger of allowing the plant to reach wilting-point will be increased, and before the irrigation can be given a serious check will result to the following crop. The farmer will probably be guided more by practical considerations than hypothetical reasons in regard to whether he will irrigate before or after cutting.

CUTTING AND CURING.

Generally speaking, lucerne should be cut for hay when the young shoots at the base of the plants are about 1 in. in length. If these shoots are allowed to grow too long they are liable to be damaged by the mower. The flowers usually appear with the second growth, but in the spring crop cannot be regarded as a reliable guide to time of cutting. The earlier the crop is cut after coming into flower the better will be the quality of the hay for cattle and sheep.

From a haymaking point of view the general weather conditions of Central Otago are ideal. Most farmers are inclined to leave the cutting of their crop too long, and in making their hay they allow it to become too dry in the field. This results in a poor, harsh hay which does not retain the leaves, and breaks like brittle sticks in the hand. Good hay should have a nice green appearance, smell sweet, bend readily without breaking in the hand, and have an abundance of fine adhering leaves. The leaves contain about 50 per cent. of the feeding-value of lucerne hay, and are to be regarded as very valuable from a feeding point of

view. The crop should be cut in the morning of a good day for curing. In the late afternoon it should be quite ready to rake into windrows with the ordinary rake, or preferably a side-delivery rake. During the following forenoon it will most probably be fit to bunch together into rough cocks with the ordinary rake, and in the afternoon of that day it may be stacked. The hay should not be allowed to cure too long in the windrow, otherwise too many leaves will be lost in raking and handling the crop. When lucerne is raked before the leaves are entirely cured they continue to draw moisture from the stem, thereby ensuring a more uniform curing.

Occasionally the baling of lucerne hay direct from the field has been attempted in Central Otago, but this operation has rarely been satisfactory, heating taking place in the bales. It is much better practice to stack the lucerne first, and bale from the stack when it is from six to eight weeks or more in age. If heating is to be avoided in baling direct from the field the hay requires to be thoroughly cured. The result is a hard hay with loss of leaf, and rarely warrants the saving of the double handling.

One of the big drawbacks to growing lucerne in extensive areas in Central Otago is the difficulty of obtaining labour to carry out harvesting operations. The average farmer has not the capital necessary to pay the high ruling rate of harvesters' wages, nor can he reasonably be expected to have a full equipment of up-to-date labour-saving devices. By co-operative endeavour much can be done to reduce the cost of harvesting, but it is to the farmer's own benefit, particularly on the smaller farms where dairying is being conducted, to sow only sufficient lucerne to provide winter hay for the cows and horses, putting the bulk of the land under irrigated pasture.

The use of hay-sweeps and derricks certainly reduces the amount of labour in harvesting and permits the building of large stacks. These are to be preferred to small stacks, as a smaller proportion of the hay is exposed to the elements.

LUCERNE AS A PASTURE.

Irrigated lucerne is essentially a hay crop, but occasionally it is used as a pasture. The practice of depasturing an irrigated stand of lucerne, on account of the liability of cattle and sheep to become "blown," presents considerable difficulties, and great care has to be exercised to prevent hungry stock from gorging themselves rapidly. In general the grazing of irrigated lucerne is not recommended, and should be confined to either the grazing of very early spring growth or the last crop of the season. The common practice of grazing the last crop or roughage of lucerne in the autumn may be regarded as quite sound practice, provided care is taken not to graze too closely. The plants should be allowed to go into winter with some growth upon the crowns, thus enabling them to stand the winter better, and also to store up reserve food material for a vigorous growth in the following spring. Where grazing is carried out the ground should be frequently cultivated with a spring-tooth harrow to loosen up the overconsolidated soil resulting from the trampling of stock.

CULTIVATION.

Under irrigation frequent cultivation of lucerne is of great necessity. One of the commonest causes of a lucerne stand rapidly going out is the intrusion of weed plants. Of these probably the grasses are most aggressive, and it is only by repeated cultivation that their invasion can be arrested. By cultivating during the winter months at least twice with a strong spring-tooth cultivator the bulk of the weeds can be kept under control. Where it is possible a cultivation after each cutting is desirable. Not only will cultivation of this description check the growth of weeds, but its secondary effect of breaking up the consolidated soil, thus separating it and lessening the rate of evaporation, will be of great advantage in maintaining the vitality of the crop. Any damage likely to accrue from this practice may be considered as negligible in contrast with the benefits conferred on the crop.

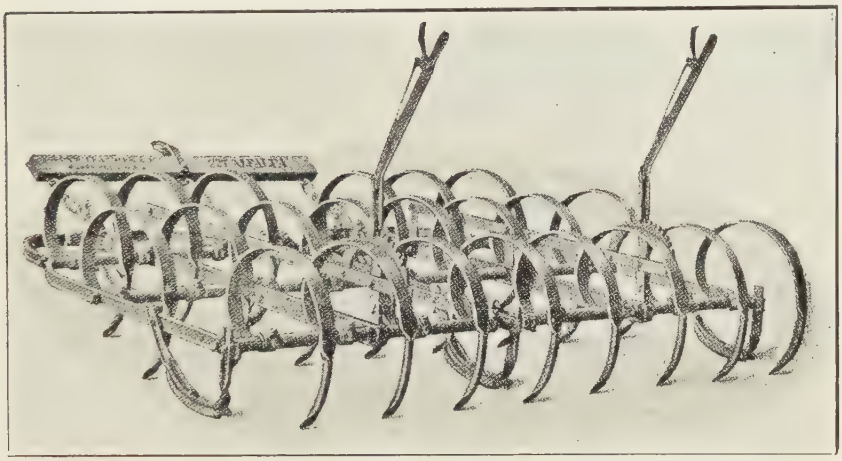


FIG. 58. SPRING-TOOTH HARROW OF TYPE SUITABLE FOR CULTIVATION OF LUCERNE.

Note the narrow teeth on the tines.

WINTER IRRIGATION.

So far the winter irrigation of lucerne has not been practised in Central Otago. In the near future, as the land becomes more closely settled and large areas of the lighter soils are brought under cultivation, it will probably be of advantage to give the land a good irrigation during the months of July or August. Winter irrigation will probably be of greater advantage on permanent pastures than on lucerne. The chief advantages of winter irrigation, apart from supplying the soil with a store of moisture, would appear to lie in the fact that lucerne is not likely to be damaged by frost, and that the mechanical condition of the soil is improved.

(To be continued.)

CONTAGIOUS PLEURO-PNEUMONIA OF CATTLE.

C. S. M. HOPKIRK, B.V.Sc. (Melb.), Veterinary Laboratory, Wallaceville.

PLEURO-PNEUMONIA is a disease of the lungs of cattle caused by a very minute organism, which, like the virus of foot-and-mouth disease, is a filter-passer. The disease was known and described as early as 1765, and since 1794 has been recognized as of a particularly contagious nature. Several commissions have made a study of the disease, which caused great loss on the Continent during its spread from Switzerland to all neighbouring States. In 1839 it passed from Holland by means of imported cattle to Ireland, and a few years later to England and the lowlands of Scotland. The United States of America also became infected from the purchase of a ship's cow as early as 1843. Later still Australia and South Africa became affected. The United States and Great Britain were able finally to eradicate the disease by slaughter of herds showing affected animals, and the trouble is now confined to Russia, Spain, Africa, Asia, and Australia. New Zealand and Tasmania, thanks to early good fortune and later to rigid quarantine arrangements, have always been free from the disease.

THE CAUSATIVE ORGANISM.

The organism causing pleuro-pneumonia is just visible with the aid of the highest power of the ultra microscope as a highly refractile spot, and until recently the exact shape was not known. However, by a special high-power photographic apparatus where exposures were made in ultra violet rays, the organism has now been found to resemble a yeast in shape and method of propagation. It has recognizable staining affinities, and was first cultivated in 1897 on artificial media by Nocard and Roux, who placed some of the lung exudate into broth in a collodion capsule and introduced the capsule into the peritoneal cavity of a rabbit. In twenty days the rabbit was killed and the broth found to be cloudy with a growth of the organism. Later this organism was cultivated in the incubator at blood-heat on solid media, and also in liquid media containing serum in a certain percentage (8 per cent.). After the liquid media had been sown, to ensure that no contaminating organisms would be found present, the whole was run through a porcelain filter. For culture purposes the organism is found pure in the lung or pleural exudate. Heat easily destroys the organism (58° C. for one hour), and cultures are found dead after one month. In ideal circumstances virulence may be retained for ten months. The lymph is attenuated considerably by air and light in three weeks, and heating at 55° C. greatly modifies the action of the organism when injected into an animal.

TRANSMISSION OF THE DISEASE.

It has been proved by experiment and careful watchfulness in the field that transmission is only by animal contact. One animal must breathe moisture and virus-laden atmosphere expired by an affected beast at a distance of, at most, only a few feet. Consequently the

disease spreads from field to field by contact of one animal with another over the boundary-fence. It is impossible to set up a typical form of the disease in any other way, and cattle which have died from pleuro-pneumonia are not a source of danger to healthy cattle on the same pasture. Contact cases take about twelve to twenty days to contract the disease.

When a young animal—which must be at least six months old, as younger animals are immune to the disease—is inoculated in the flank with a small dose of the virus-culture or lymph exudate from the lungs, after six to twenty-seven days a rise of temperature occurs and a doughy swelling appears at the seat of inoculation. The neighbouring lymph-glands become enlarged, and sometimes there is a breakdown of the centre of the swelling. If a bruising of some other part of the body has occurred there is occasionally a lesion formed in the bruised area, which rather disproves the belief that the disease is purely local in character. The lungs have never been known to become affected from any form of inoculation. Ingestion of affected material is also harmless.

SYMPTOMS.

At first the symptoms are often confused with digestive disorders, this being due to irregular rumination, capricious appetite, dull appearance, and roughened coat; but in a few days the gait of the animal changes and becomes slow and uncertain, it cannot turn without evidence of pain, percussion of the thorax causes a cough and often a peculiar moan, the pulse is accelerated and the temperature high. At a later stage the fore limbs are kept wide apart, the animal remaining still; the nose is lowered and projects in line with the neck; breathing becomes abdominal, and the cough is more frequent and usually moister. There is very often at this stage a characteristic moan during expiration, sometimes marked and at other times hardly discernible, at the nostrils. By percussion methods a line of pleural effusion can be made out in the thorax, and a zone of dullness over a large area of one side of the lungs. Sometimes both sides are affected. This dullness is due to increased density of the lung, through effusion of exudate into the lung-tissue, so that pneumonia and pleurisy are combined, as indicated by the name of the disease. Often an œdema develops beneath the chest. Abortion is a common sequel. The animal may last for ten to fifteen days, when it may die either from suffocation or of general poisoning from the disease. Should the cow live, the lesions become chronic, and the animal either survives for several weeks or gets partially well to a stage when she is a menace to all her neighbours in the herd as long as she lives. In an outbreak the symptoms as described are those usually seen, but sometimes the animal may die from a peracute form in about two days, or else, in a subacute form, linger on for weeks. In mild cases only a small rise of temperature will be present to give any indication that the animal is affected.

In a clean country where the disease has recently been introduced the death-rate is about 80 or 90 per cent., but where the trouble is old standing and precautions are taken 30 per cent. is reckoned upon.

DIAGNOSIS.

A diagnosis is based usually on a knowledge of the prevalence of the disease, the number affected in a herd, and on *post mortem* examinations of a suspected case. Pleuro-pneumonia may be mistaken for several other conditions before death, but after death the state of the lungs narrows the trouble down to one of two—hæmorrhagic septicæmia ("corn-stalk disease" of U.S.A.) and pleuro-pneumonia. These are easily differentiated with the aid of the microscope, as they are caused by totally different organisms. Seen before incision the lungs appear non-collapsed and swollen; they sink in water, and feel more or less like liver; when incised a clear straw-coloured fluid exudes and later coagulates. This cut surface has a beautiful marbled appearance, which is caused by the white streaks of connective tissue running between the lobules being greatly distended with exudate in the lymph spaces. Between these white lines are islands of various colours, some dark red, others scarlet, and others, again, muscle-coloured or pale yellow-pink. This thickened area of the lung fades off into the still active lung-tissue.

As the disease becomes chronic the solid area is enclosed in a capsule of fibrous tissue, and, if the animal survives, the piece of lung so enclosed becomes necrosed and dry owing to a shutting-off of the blood-supply. This condition is dangerous, as the area may open up at any time, and the organism of the disease appears to be ever ready to take advantage of such an opening. The position is that either the animal will get a second attack of the disease or it will act as a potential carrier for the rest of the herd. It is for this reason that any cow affected must be killed and not allowed to convalesce. Only rarely does a sloughing of the lungs occur, as the lung-lesion is so well enclosed that other organisms do not easily gain entrance, and they are seldom imprisoned in the area. On the walls of the lungs there is usually to be seen a thick creamy layer of deposit, with some 2 gallons of a clear fluid in the chest-cavity itself.

Where intramuscular inoculation of an animal is carried out for obtaining active lymph, the muscles show just such a marbling as is seen in the lungs, together with a quantity of serum which causes the doughy condition of the swelling.

There are several scientific laboratory methods of identifying the disease: (1) Cultivation in broth plus serum, after passing through a porcelain filter; (2) the agglutination test, in which the serum of an affected animal in certain dilutions has the property of causing the organisms to mass together and form a deposit on the sides and bottom of the tube; (3) the complement fixation test. The last two methods have been perfected recently by Major G. Heslop, at the Veterinary School, Melbourne. Major Heslop also keeps pure cultures in stock for the work of immunizing animals against the disease.

IMMUNIZATION.

To gain an immunity several methods are in vogue. That of Willem is the simplest. By this method a small amount of lung-lymph is taken from an animal killed while affected with an acute attack of the disease, and inoculated into the tip of the tail. The method has several drawbacks, such as the loss of tails in 5 to 15 per cent.

of cases, the transmission of other diseases, such as tuberculosis, into the inoculated animal, and sometimes death from general invasion of the perineal and pelvic regions. Immunity is established for twelve months. Pasteur, by his method, obtained lymph from an experimental animal from the inoculated area behind the shoulder, and mixed his lymph with one part of glycerine to two of lymph. This material remains effective for six weeks if kept on ice. By this method no other disease is likely to be given to the animals being immunized. Theiler, in South Africa, advocates drenching cows with either the lymph itself diluted with water or else pure culture. Many say that no immunity is established by this method. Heslop, in Australia, and many workers in France prefer to use a pure culture for tail inoculations. By this method there is little loss of tails—only 0·7 per cent. in France—and the risk of inoculating other diseases is absent. Nocard prepared a hyper-immune serum, and by giving large doses could obtain a passive immunity for eight to ten days, and even a curative action with huge doses, but this is of little practical value in the field.

CONTROL MEASURES.

In order to combat the spread of the disease in any country stringent precautions are necessary. In Victoria the regulations make it necessary for the farmer to notify the Stock Department at once by wire of such an outbreak, or even of a suspected case. The farm is at once strictly quarantined against outgoing animals, except where affected cattle are being driven to the abattoir under orders from the Veterinarian in charge. The neighbours are placed under a zonary quarantine, which necessitates them having their cattle effectively inoculated. Stock visibly affected are slaughtered at once. Others have their temperatures taken daily, and a rise of one degree acts as a death-warrant, as no animal must be allowed to recover from the disease to be a potential carrier. Occasionally the agglutination test is applied in doubtful cases on a farm where the outbreak is not typical. Cattle not affected are inoculated with culture or with lymph from the lungs, and in the zonary quarantine, so long as a death does not occur, no temperatures are taken. Quarantine lasts for thirty to sixty days from the last known case.

The very serious nature of pleuro-pneumonia will thus be seen. Were the disease to find its way into this country it might very quickly take control and spread from district to district, causing some 80 per cent. of deaths in the affected herds. The necessity for the existing restrictions on the importation of cattle into New Zealand will readily be apprehended by stockowners.

Vaginitis in Dairy Cows.—In regard to the 1923–24 season the Live-stock Division reports that a considerable amount of trouble was again experienced among dairy herds from vaginitis in its various forms, often accompanied by sterility. Fortunately, although indications point otherwise, a number of the cows affected continue to hold and come into profit at the usual time, but others do not, and the loss is severe. The treatment advised by the departmental officers has been found to give satisfactory results, but, owing to failure in many cases to detect it in its early stages, the treatment has to be continued over a much longer period, and it is sometimes difficult to get farmers to conscientiously carry it out over the period necessary.

REFRIGERATION AND CHEDDAR CHEESE.

CURING, STORAGE, AND TRANSPORT.

Paper read by WALTER WRIGHT, Inspector of New Zealand Dairy Products, London, at the International Congress of Refrigeration, London, 1924.

I DESIRE it to be understood that the matter contained in this paper deals only with cheese of the Cheddar variety, and has been based upon methods adopted in the export trade of cheese from New Zealand. It will be readily understood that owing to the geographical position of New Zealand such development of trade could not have been made possible without the aid of mechanical refrigeration.

One of the most important factors in the production of Cheddar cheese of a good sound commercial quality is that of adequate control of temperature, not only as applied to the manufacturing and storage branch of the business, but also in the care of the raw material which the cheesemaker has to handle in the production of such cheese. Probably one of the weakest points in the cheesemaking industry to-day is the lack of this most essential feature in the handling of milk at the source of production—that is, the dairy farm. To enable farmers to deliver their milk to the cheese-factory in the best possible condition they must have at their command some effective system of cooling the milk, at all times having in view the desirability of reducing temperatures from blood-heat in the shortest possible time after the milk is drawn from the cow. With regard to this phase of the industry I feel that there is the need of some small but efficient type of refrigerating-machine, obtainable at a reasonably low cost to farmers, that could be run in conjunction with a direct-expansion cooler for the purpose of cooling the milk immediately it is drawn from the cow. I suggest that this is a matter worthy of the consideration of not only dairy-farmers but also of manufacturing engineers. Undoubtedly in some countries, where large quantities of milk are handled by individual farmers, there should be a market available for small machines of this type.

COLD CURING.

Although it is some twenty years since experiments were carried out at the Wisconsin Experimental Station by Babcock, Russell, Vivian, Barr, and others, the full application of the principles of cold curing of cheese is far from being a general dairy practice so far as Cheddar-cheese production to-day is concerned. This is somewhat surprising, because the initial cost of installation of mechanical refrigeration is not great, and such costs are rapidly obliterated by the saving in the loss of weight and the improved quality of the cheese so treated during the process of curing. As is well known, cheese loses considerable weight after being manufactured, but such loss is governed in extent largely by the temperature of the atmosphere to which the cheese has been submitted. It therefore follows that the lower the temperature consistent with safety and a normal ripening of cheese, the lower will be the loss caused through the evaporation of moisture.

Probably the most important feature in cold curing of cheese—say, between 45° and 50° F.—is the improvement in the flavour when compared with cheese that has been cured in curing-rooms where no satisfactory arrangements have been made for the control of summer temperatures. Experience has taught us that the cheese can be taken from the press and placed on the shelves in the curing-room, where temperatures are held between 45° and 50° F., with perfect safety so far as the ultimate condition of the cheese is concerned. Cheese cured or ripened in such temperatures have, almost without exception, been found to develop a mild clean flavour, and with increase of age is found to retain those characteristics. This indicates that at the lower range of temperature the desirable colonies of bacteria or enzymes continue their work normally, while those of the undesirable type suffer a severe check on account of the temperatures being unsuitable for the development of the undesirable flavours that develop so exceedingly when cheese is ripened at high temperatures such as those of midsummer. Like many other old-fashioned theories in the world of cheesemaking, the theory that comparatively high temperatures are necessary for the normal ripening of cheese has been entirely upset, as is illustrated by the practical results obtained by the cold curing of cheese to-day.

Respecting abnormal fermentations, cheese is so admirably adapted as food material for the development of bacteria, many kinds of which are able to produce deleterious changes in it, that the influence of temperature on the rate of such bacterial activity is a matter of considerable moment. Gassy cheese is particularly associated with high-temperature curing. Regarding body and colour, it has also been found that cheese cured at 33° to 40° F. when cut presented a perfectly solid even appearance and remained so as the curing progressed, while when cured at 60° F. the cheese were more or less open and frequently bleached, presenting a mottled appearance, which increased as time went on. Further, the experiments conducted show that through the slower ripening the cold-cured cheese keeps in good condition much longer than that where rapid ripening takes place under higher temperatures—a fact of considerable importance to the cheese-dealer who may have to carry the cheese for some time. A bacteriological examination of cheese held in cold store fourteen and seventeen months showed, when the cheese was removed from cold storage, that lactic-acid-producing forms and inert species were most abundant; very few liquefying and no gas-producing organisms were found. (Bulletin 94, Agricultural Experiment Station, Wisconsin.)

The benefits of the application of cold curing of cheese can be summed up as follows: (1.) It delays the curing not more than a week or ten days. (2.) It effects a direct gain by saving from 1 per cent. to 1½ per cent. in the shrinkage of cheeses that have not been paraffined during the period of curing. (3.) It eliminates the heated flavour and mealy texture that are characteristic of all ordinary cured cheese in hot weather. (4.) It tends to prevent the development of undesirable flavours in many cheeses which would otherwise be very inferior on that account. (5.) It protects the cheesemaker in some measure from merchants' claims arising from causes over which he has no control. (6.) Cheese which has been properly cold-cured does

not require subsequent storage at extremely low temperatures to check the injurious processes which are set up by high temperatures, but may be kept in good condition with that nutty flavour essential to Cheddar cheese. (7.) The general improvement in the quality increases the consumption of cheese enormously, and, by thus increasing the demand, ensures a better average price. (Report of the Dairy Commissioner, Canada, 1906.)

It will be noted that both the authorities quoted appear to be entirely in accord as regards the benefits to be derived from the policy of cold curing. In New Zealand to-day the tendency is to take an intermediate course by adopting a temperature of from 45° to 50° F. for the curing-room—a practice that is giving good results, and, so far as my investigations have gone, this system is working quite satisfactorily and beneficially. It has to be realized that when cheese has been submitted to the ill effects of high temperature its quality suffers irreparable injury, which can only result in disappointment to the maker, financial loss to the owner, and dissatisfaction on the part of the buyer. Where such damage has taken place I know of no practicable steps that could be taken to eliminate the injury that the quality of the cheese has sustained.

It is most important that all vehicles for the conveyance of cheese from curing-room to cold store should be in such a condition as to prevent any damage to the condition or quality of the cheese during transit. Not infrequently this is a stage in the handling of cheese where it sustains damage owing to the lack of proper control of high temperatures.

COLD STORAGE.

In regard to the cold storage of cheese it has been found that the wet-battery system gives the best results, with air-temperatures in the chambers held at between 40° and 50° F. for short storage. For long storage, however, temperatures can be reduced with safety to 36° and give satisfactory results. Holding cheese at about this temperature has proved to be beneficial in that it retards the development of mites and moulds very materially. To ensure the safe and satisfactory cold storage of cheese packed in cases it might be well to mention here a few of the essential points that must be observed if results are to be satisfactory.

(1.) It is most important that the cheese should be in a fit condition for packing. The cheese should be at least fourteen days on the shelves of the curing-room, or longer if necessary, so that the rinds and tops and bottoms of the cheese may become dry and firm. To enable this to be done it is necessary that the cheese should be turned once every day during this period. If the cheese is packed before that time there is the danger that it will not stand any length of cold storage satisfactorily. There is a probability of the cheese turning out in bad condition, particularly on the tops and bottoms, because, if the rinds of the cheese are moist and soft at the time of packing, and it is placed in cold storage in that condition, putrefaction will eventually develop at the points of contact between the cheese and timber. The result is that if held for any lengthy period without attention such portions of the cheese will eventually become unfit for human consumption.

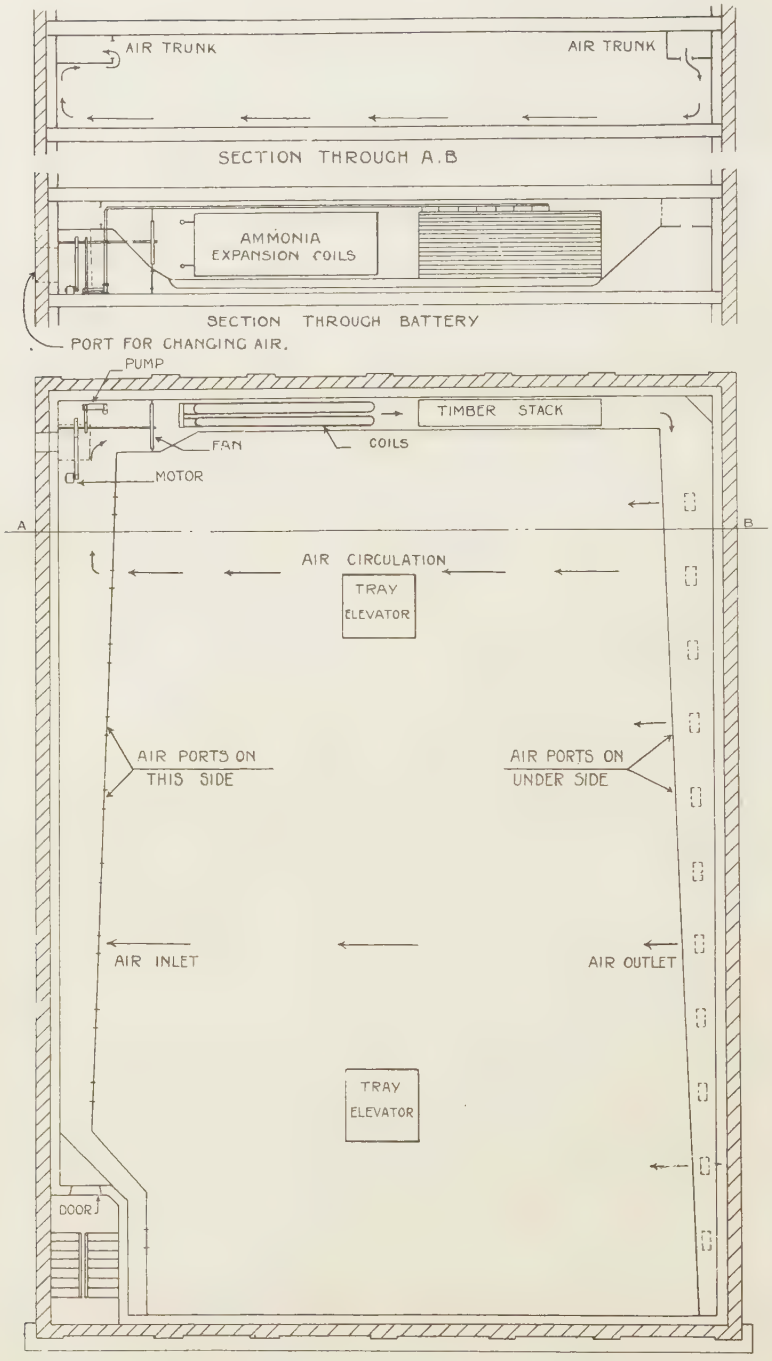
(2.) It is imperative that no cheese should be stored away in any but dry and thoroughly seasoned packages, and scale-boards should always be used. If this safeguard is neglected and the cheese is packed in green and wet timber the condition of the cheese will be found on being withdrawn from storage to be unsatisfactory, owing to the crowns having become soft and pappy and in a more or less state of decomposition, according to the time the cheese has been held in cold storage and the degree of moisture to which it has been subjected.

(3.) The question of an efficient air-circulation in the chambers has to be considered. To obtain satisfactory results all chambers require to be fitted with trunks to take the air as drawn from the battery by the fan to the several points. A system that provides trunking, with delivery-ports on one side and outlet on the other or return side of the chamber, has been found to give good results. From experiments and experience it has been found that it is better to have a large circulating-fan, thus moving the air at a comparatively slow velocity, but at the same time sufficient to keep the air moving, than it is to use a small fan driven at increased speed moving the air at a high velocity. The latter method has a tendency to crack the rinds and dry out the cheese, as it practically subjects it to what might be termed a "forced draught" treatment.

(4.) A proper adjustment of the air-delivery ports is most important, and requires frequent attention so as to provide an equable discharge of air-currents. Whatever the speed of air delivered from the various ports may be, it is advisable to use baffle-boards when the cheese is stacked close to and in direct line with the air-delivery, so as to prevent the drying-out of the cheese on which the direct air-current would otherwise impinge. Where large quantities of cheese are stored the use of large canvas screens is beneficial in the gangways between the stacks for deflecting the air-circulation through the stacks of cheese. This assists in keeping temperatures more uniform in large chambers that are filled with cheese. Temperatures are found to be irregular when there is no adequate air-circulation. Air-circulation also carries off any excess moisture there might be in the chamber.

(5.) The humidity of air can be governed, within certain limits, by the density of calcium-chloride brine that is running over the direct-expansion coils of the battery. If the air is allowed to become too dry considerable loss in weight will take place, and cracked rinds will also be the result. On the other hand, too heavy moisture will cause heavy condensation to settle upon the cheese, which, if allowed to continue for any length of time, will cause decomposition, commencing on the outside of the cheese and working inwards. Cheese submitted to such conditions will, in the space of a few weeks, begin to show decomposition, particularly on the crowns or tops and bottoms of the individual cheeses.

(6.) With reference to adequate cooling-power in the matter of cheese storage, herewith is presented a plan of the first, second, and third floors of the cheese-store of the Auckland Farmers' Freezing Company. These rooms form part of and are attached to a large block of buildings owned by the same company, and used for the storage of butter, cheese, fruit, &c., and for the manufacture of clear can ice. Each of the three stories forms one large self-contained storeroom



ARRANGEMENT OF ROOMS FOR CHEESE-CHILLING AT THE AUCKLAND FARMERS' FREEZING COMPANY'S COLD STORES, KING'S WHARF, AUCKLAND.

The first, second, and third floors of the cheese-store are fitted on this plan.

containing 66,000 cubic feet of space, each room being provided with an independent battery for cooling and purifying the air, together with the necessary air-trunks.

The building is of brick, plastered on the outside, four stories high, and roofed with asbestos tiles. The insulation of the walls is 12 in. of calcined pumice contained between the brickwork and a 6 in. by 1 in. tongued and grooved lining nailed to 6 in. by 2 in. studs, the face of the studs being 12 in. from the brick wall. Between the brickwork and pumice and between the lining and the pumice is a layer of hard felt, $\frac{1}{16}$ in. thick, saturated with bitumen. This serves a double purpose—to prevent moisture getting into the pumice, and to retard air-filtration, which also carries moisture into the insulation.

The floors and ceiling are all insulated with 12 in. of pumice filled in between the joists. Bituminous felt is stretched on the under-side of the joists before the 6 in. by 1 in. tongued and grooved ceiling-boards are nailed up, and the pumice is then filled into the space between the joists and flush with the top; another layer of felt is put over this before the flooring-boards are nailed down.

All crates and cases are taken up or brought down by swinging-tray elevators capable of handling thirty crates per minute. These are fitted with loading and discharging grids on each floor, so that the cheese can be transferred from any floor to any other at this rate. Roller chutes are also used to a considerable extent.

The refrigerating plant for each room consists of 2,400 ft. of $1\frac{1}{4}$ in. ammonia piping in two coils. These coils stand in a steel tank 12 in. deep. Beyond the coils in the direction in which the air flows is a "stack" of battens on edge, or corrugated galvanized iron on end. Chloride-of-calcium brine is drawn from the tank by a centrifugal pump, and discharged in a shower by suitable sprinklers over the expansion-coils and stack. Ammonia is expanding in the coils and cooling the brine as it runs over the coils; this cold brine on being showered over the stack further reduces the temperature of the air which comes in contact with it.

At the inlet end of the battery is a propeller fan having a theoretical capacity of 30,000 cubic feet of free air per minute, but in actual practice the amount is very much less than this. It is estimated that the air in the chambers is circulated about fifteen to twenty times per hour. (In more recent practice the fan is placed at the outlet end of the battery and the air drawn through the coils and stack.) The fan and pump are driven by a suitable electric motor.

In connection with this system it is necessary to provide some means of concentrating the brine, as any moisture evaporating from the cheese is condensed in the battery and increases the volume of the brine, and, of course, weakens it. In concentrating the liquid by boiling, the characteristic flavours of cheese are driven off and the brine purified, but there is a limit to the extent to which this can be carried out, as in time the brine becomes "sick" and must be renewed. By increasing or decreasing the density of the brine the humidity of the air in the chamber can be controlled within certain limits. The density of the brine should be maintained at a point at which it will not freeze on the coils, and which will maintain a percentage of humidity suitable for the cheese during storage. This

method of cooling and washing the air at the same time keeps the air in the chambers in a clean, sweet, and dry condition. The reason for circulating such a large volume of air per minute is that it eliminates great differences in temperature. In this plant the greatest difference of temperature in the battery and storeroom does not exceed two degrees Fahrenheit.

The Auckland Farmers' Company has freezing and chilling rooms with a total capacity of nearly two million cubic feet, operated with air-circulation and wet battery. In one case the battery contains 52,000 ft. of 1¼ in. piping. For these details I am indebted to Mr. T. Simpson, managing director of the company.

(7.) My experience has been that the amount of gas thrown off by the cheese during the early stages of cold storage is governed very largely by the temperature of the cheese when it is first placed in cold store. The higher the temperature of the cheese at that time the greater will be the exudation of carbon dioxide.

Mr. F. W. Grainger, then manager, West Coast Refrigerating Company, Patea, New Zealand, supplies the following notes regarding the storage of cheese at his company's works :—

"Cheese in cold storage gives off a considerable amount of gas, which in time makes the chambers very foul. This must be got rid of by blowing out the chambers through special outlet-ports, and taking in fresh air at the inlet end of the cooler. But we find by boiling our brine, taking a portion from each of the coolers every day for concentrating, thus getting rid of moisture taken up by the calcium chloride, and keeping the brine-density constant and adding the fresh concentrated brine, that we eliminate the gases as they are taken up in the calcium chloride and got rid of by boiling. This, in my opinion, is better than adding humid air from the atmosphere, as the latter tends to assist mould-growth on the cheese. The brine-circulating pump is fitted with a suitable bypass connection for taking out weak brine and delivering it to the concentrator, and for returning concentrated brine to replace the quantity taken out. It is an important point to make sure that brine is the right density, and to ensure an even flow over the coils so that they do not freeze over with a coating of ice, in which case the efficiency of the cooler will be lost."

OCEAN TRANSPORT.

Shipping companies in the New Zealand trade have not yet adopted a uniform system of refrigeration on board the various vessels as far as the carrying of cheese cargoes is concerned. The systems in use might be briefly described as follows : (1) Brine-circulation ; (2) air-circulation from expansion batteries ; (3) air-circulation from side grids. The following examples afford a brief description of the arrangement of the pipes and the fitting up of the various chambers :—

Brine-circulation : Capacity of chamber, 37,100 cubic feet ; pipe measurement used, approximately 3,700 ft. run over piping 2 in. O.D. ; insulation used, silicate cotton. The method of brine refrigeration is that cold brine of a suitable temperature for maintaining the required temperatures in the cheese-chambers is pumped continuously through brine-piping, being arranged in the form of grids and secured to the sides, bulkheads, and roof of the chamber. The feet-run and

disposition of the piping used is adjusted by the engineer, who can control the circulation from the refrigerating-machinery room to suit the conditions in the cheese-chambers. In this style of chamber no arrangements are made for air-circulation. The insulation used varies in different vessels, and charcoal, silicate cotton, and granulated cork are all good insulating-materials, the latter, however, having been used in all the later vessels.

Air-circulation from expansion batteries: Capacity of chamber, 27,800 cubic feet; insulation used, charcoal; air-circulation per hour, 3,000,000 cubic feet for two fans; size of fan (2 off), 5 ft.; fan-revolutions, 300. The cheese-chamber referred to under this heading is one of six cargo-spaces, having a total cubic capacity of about 285,000 ft., and the vessel is fitted with two ammonia expansion batteries and two fans, one for each battery. The practice is with a full cargo of frozen meat and dairy-produce to work both fans and batteries, although one installation—that is, one fan and one battery—is sufficient to maintain required temperatures in all insulated chambers.

Air-circulation from side grids: Capacity of chamber, 34,312 cubic feet; insulation used, granulated cork; air-circulation per hour, 300,000 cubic feet; size of fan, 20 in. sirocco. The arrangement of this system of refrigeration consists of converting the brine-grids on the sides and bulkheads of the chamber into an air battery by fitting planed boards in portable sections in front of the grids, forming a 12-in.-wide air-duct all round the sides and ends of the cheese-space. A series of air-holes are cut in the wooden shutters, and the sirocco fan circulates the air across the chamber, the suction being at one side and the delivery at the opposite side; the 20 in. fan is used exclusively for the chamber referred to. Details of these systems are from Messrs. William Replen, Son, and Swinston, refrigerating engineers, London.

The successful carriage of cheese in ocean steamers is governed very largely by the condition and temperature of the cheese when being shipped, and, from personal observations, I am of the opinion that the temperature of cheese intended for long-distance transport should be reduced to approximately carrying temperatures before being placed on board ship. If it were possible to carry out the same methods of observation and control on board ship as are adopted in cold store on land, precooling would not be so important; but as such is not possible it is essential that cheese-temperatures be comparatively low in the first instance if the best possible results are to be obtained. Before passing on I would like to record my opinion that at no period during the life of cheese, from the time of manufacture until it reaches the retailer's shop, should there be any need for precooling, because at every stage of its life the temperature should be controlled right along the line. It should be remembered that in the transport of cheese it is not possible to use a treatment similar to that adopted with frozen produce. Frozen produce is delivered on board ship in a frozen condition, and all that the steamship people are required to do is to hold the produce at the requisite temperature.

Experience has taught us that the higher the temperature of the cheese when taken on board the greater are the difficulties that

engineers have to contend with, and the most careful and watchful manipulation of the cooling-system becomes necessary. The higher the temperature of the cheese the longer will be the time before the air of the hold can be reduced to the required temperature, say, 40° to 45° F., or the figure that may be stipulated by shippers, owing to the danger of creating undue condensation, which, settling on the cheese, brings about rapid deterioration in the condition of the cargo. Taking, for instance, a shipment of cheese at an average temperature of, say, 60° to 65° F., it will be some nineteen to twenty-one days before the air in the hold can be reduced with safety to the temperature required.

Under such conditions it will be easily understood that in addition to the deterioration in condition of the cheese the quality is likewise seriously affected, owing to the rapid ripening process and the undesirable development of ill flavours common to high temperatures. At the same time such conditions favour the growth of gas-forming bacteria, which adversely affect the texture of the cheese by causing the formation of gas and other holes or openings of various types, and at the same time bring about a looseness of texture, all of which are most undesirable in cheese of the Cheddar type.

In the stowing of cheese in the holds it is important that there should be no dripping of moisture from the brine-pipes or trays overhead. Personally, I do not recommend the use of overhead grids in the transport of cheese, owing to the danger there is of damaging the cheese that may be carried underneath. It is also important that there should be a clear space of, say, 12 in. between the side grids and timbers, and false bulkheads should be carried from the ceiling to the deck of the hold so that no cheese can be stowed underneath the grids or scuppers, the latter being erected to carry off the moisture from the brine-pipes. In cases where these precautions have not been taken certain quantities are not infrequently landed in a more or less damaged condition. Until quite recently the common practice has been to carry cheese in the 'tween-decks of the vessels, but owing to the great increase in the quantity it has also become necessary to carry it in the lower holds, and results have been, on the whole, fairly satisfactory.

With regard to the temperature in the cheese-holds, I have found by experience that temperatures in different parts of the hold are variable. For instance, taking a cheese-chamber in which the depth of the hold will allow the cheese to be stacked, say, from eight to ten tiers high, I have repeatedly found that the temperatures rise approximately one degree for each tier in the elevation. This I believe to be caused through the lack of efficient power for the complete circulation of air in the holds.

In conclusion, I desire to emphasize that it is just as important to have efficient air-circulation in the cheese-holds on board ship as it is in the cold stores, because efficient air-circulation means uniform temperatures, and also, what is probably as equally important on board ship, the drawing-off of carbon-dioxide gas when heated cargoes have been taken on board.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS.

J. W. DEEM, Instructor in Agriculture and Supervisor of Subsidized Demonstration Farms.

OPERATIONS at the Stratford Demonstration Farm continue to progress steadily, stumping and general improvements being carried out as fast as finance permits. Of the total area of 143 acres, over 100 acres have now been stumped and about 90 acres sown down to new pasture. Tree plantations and hedges have made good growth and now afford considerable shelter.

PASTURES.

The practice of building up fertility by turning under green crops is now receiving attention, the procedure being to sow a temporary mixture of 30 lb. of Italian rye-grass and 6 lb. of red clover, feed this for a year, and then turn under a rich growth of green material, mostly clover. This greatly improves the humus and mechanical condition of the land, and better permanent pastures may be expected as a result.

The best pastures on this farm are sown in November. Budda kale, 1 lb., is drilled in with basic super, 1 cwt.; the land is then rolled and the grass-seed broadcasted. Various mixtures and weights of seeding have been tested, and on the average the following mixture has given the best results: Cocksfoot, 12 lb.; perennial rye-grass, 16 lb.; Italian rye-grass, 4 lb.; timothy, 3 lb.; dogstail, 2 lb.; cow-grass, 3 lb.; white clover, 2 lb.: total, 42 lb. per acre. Akaroa, local, and imported Danish cocksfoot have been tried against one another; so far we cannot see any difference; but this work is being continued. Imported white clover is also being tested against colonial and imported Dutch, but it is too early as yet to form any conclusions.

Various manures have been tested for top-dressing, and the results up to the present indicate that basic slag is decidedly the best for Stratford conditions, basic super and mixtures of lime and super coming next. The tests with Nauru rock phosphate indicate that the material is slow-acting, it being the second year before any noticeable improvement can be seen. Dressings of all manures have varied from 2 cwt. to 6 cwt. per acre. At present we are inclined to favour 3 cwt. the first year, and 2 cwt. per year afterwards, results so far indicating that a medium dressing each year is superior to a heavy dressing at long intervals. This is in keeping with the general results in Taranaki. So far neither nitrogenous nor potassic manures have shown any beneficial results when used on this farm. Kainit in conjunction with basic slag is being further tested this year.

ROOT CROPS.

Areas of turnips, swedes, mangolds, and carrots have been sown each year. The average yields per acre for the last six years are: Turnips, 40 tons 3 cwt.; swedes, 39 tons 1 cwt.; mangolds, 43 tons 11 cwt.; carrots, 31 tons 13 cwt. The best average for any one year has been: Turnips, 45 tons 9 cwt.; swedes, 43 tons 7 cwt.; mangolds, 52 tons 10 cwt.; carrots, 42 tons 12 cwt.

Individual varieties have given much heavier crops. Varieties that have given best results are: Mangolds—Prizewinner, White Sugar, and Red Intermediate; carrots—Matchless White and Sinclair's Champion; turnips—Red Paragon, Hardy, and Imperial Green Globe; swedes—Vilmorin's White Purple-top, Grandmaster, and Superlative.

Each year it is becoming more difficult to grow swedes owing to the ravages of dry-rot and club-root, and unless there is an improvement it will not be long before the growing of swedes is discontinued. A number of new varieties are tested each year, and so far Vilmorin's White Purple-top stands out as a rot-resister, but unfortunately supplies of seed are not available at present.

GREEN CROPS.

Mixtures of cereals and tares or peas are grown from time to time, mostly for hay. In view, however, of the difficulty of growing soft turnips, various varieties of peas for feeding green in the autumn are being tested.

LUCERNE.

Owing to the heavy average rainfall experienced at Stratford lucerne does not do its best there, it being difficult to keep stands free from grass and weeds. A small test area was sown in January, 1921, part with manure and part without; various systems of sowing were also adopted. The following table, giving the green weight yields of six cuts, from 1921 to 1924, presents several features of interest. The manure consisted of basic slag at 3 cwt. per acre applied at time of sowing. The area was also limed, one-half with carbonate at 12 cwt., and the other half with burnt lime at 6 cwt., per acre, but no difference is noticeable between these two parts.

Date of Cuts.	21 in. Drills. No Manure.	21 in. Drills. Manure.	14 in. Drills. No Manure.	14 in. Drills. Manure.	7 in. Drills. No Manure.	7 in. Drills. Manure.	Broadcast. Manure.
			Grimm Variety.				
	T. c. lb.	T. c. lb.	T. c. lb.	T. c. lb.	T. c. lb.	T. c. lb.	T. c. lb.
21/11/21 ..	..	4 19 96	..	..	..	..	..
13/1/22 ..	..	5 2 96	..	..	..	..	..
18/1/23 ..	..	6 15 0	..	..	..	..	..
19/3/23 ..	..	3 17 0	..	..	..	..	..
23/11/23 ..	..	5 2 84	..	..	..	..	..
14/1/24 ..	..	3 4 28	..	..	..	..	..
Total weight per acre (green)	..	29 1 80	..	..	..	..	..
			Marlborough Variety.				
21/11/21 ..	5 2 72	5 12 56	5 19 0	6 8 64	4 16 38	6 15 0	4 16 0
13/1/22 ..	5 12 56	5 19 0	5 9 32	7 1 48	4 10 0	9 0 0	4 19 72
18/1/23 ..	7 7 84	8 3 84	6 18 0	8 16 84	7 7 84	11 11 28	6 8 56
19/3/23 ..	4 13 0	5 2 84	3 10 56	5 2 84	4 0 28	5 9 28	3 10 56
23/11/23 ..	4 16 28	5 9 28	6 2 0	6 15 0	4 3 56	7 7 84	5 6 0
14/1/24 ..	3 10 56	4 10 0	4 3 0	4 16 28	3 1 0	3 6 0	3 4 28
Total weights per acre (green)	31 2 72	34 17 28	32 1 88	39 0 84	27 18 94	43 9 28	28 4 100

Total for three manured areas, 117 tons 7 cwt. 28 lb.; total for three non-manured areas, 91 tons 3 cwt. 30 lb.: difference in favour of manure, 26 tons 3 cwt. 110 lb., or 29·34 per cent.

It will be noticed that the method of 7 in. drills, and manuring according to the Department's recommendations, resulted in the heaviest

yield. Although the results generally are fair, we are not yet sure that it pays to grow lucerne at Stratford.

THE DAIRY HERD.

The herd is gradually being improved by the use of a good sire and better feeding. A considerable number of the cows now in profit were bred on the farm. The following figures give some indication of the improved returns :—

Year.	Average Butterfat Production per Cow. lb.	Average Butterfat Production per Acre. lb.
1919–20	.. 221·10	60·8
1923–24	.. 305·0	108·9

Both factors mentioned have helped towards this increase, but better feeding has been responsible for most of it.

VIEW AT STRATFORD DEMONSTRATION FARM, SHOWING LAND CLEARED OF STUMPS.

The milking-shed and other farm buildings are seen on right, and the homestead on left.

[*Photo by E. B. Levy.*

GENERAL.

The results obtained at the farm and published at some length by the district papers are carefully followed by a large number of farmers. Field-days are held at the farm from time to time, and these are attended by numbers of farmers from various parts of Taranaki. Also, the farm being always open, interested persons drop in from time to time to view the work and have a chat on farm matters, the manager, Mr. Hartwig, being always glad to see visitors. On field-days the committee attend in force. They also meet on the second Wednesday in every month, and generally two or three members, including the chairman, visit the farm in the afternoon for the purpose of reviewing the farm-work and meeting any people who care to attend. Some of our visitors make the criticism that we are not doing enough experimental work, but the policy of the Farm Society is more demonstrational than experimental. There is no doubt that a great deal more could be done if money was available, but as our income must be earned before it can be spent we can only advance at a moderate pace.

FIELD EXPERIMENTS AT HILLERSDEN.

LUCERNE AND PASTURE ESTABLISHMENT.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

For the past year or two co-operative experimental work has been in progress on two farms in the Hillersden district, Upper Wairau Valley—on those of Mr. D. Black and Mr. A. Bishell respectively. An inspection of the plots was made on the occasion of a field-day held in October last, when observations were recorded as below.

LUCERNE.

The experiments on Mr. Black's property deal with lucerne-culture. The lucerne in question was sown on 16th November, 1923, with Marlborough-grown seed, at the rate of 14 lb. per acre. Where inoculation was used, Farmogerm bacterial culture, mixed with moist soil, was employed. This method of inoculation is not usually practised, it being more usual to treat the lucerne-seed with Farmogerm. Where manure was employed it consisted of 1 cwt. of a mixture composed of ½ cwt. blood-and-bone and ½ cwt. superphosphate. Lime, when used, was applied at the rate of 1 ton per acre during the winter previous to sowing.

For those not well acquainted with Wairau Valley soil-conditions it may be explained that while on the lower reaches of the plain the soil ranks with the best in the Dominion, Hillersden is situated at the upper or western end of the valley, where the soils have been subjected to much erosion in the past through river-action. Consequently Hillersden soils generally are fairly poor, and markedly deficient in lime. The typical flats of the district consist of a clay loam with a fair admixture of stones and shingle. Such soils as these, it will be at once seen, present various difficulties where lucerne-establishment is concerned.

The experimental plots, working from east to west, are as follows: No. 1, limed, manured, and inoculated; No. 2, manured and inoculated; No. 3, limed and manured; No. 4, limed and inoculated; No. 5, limed only; No. 6, manured only; No. 7, inoculated only; No. 8, control plot—no inoculation, lime, nor manure.

From a comparative standpoint these plots provided most instructive results. No. 1 was of a rich dark-green colour, the lucerne being of uniform growth and fully 5 in. or 6 in. higher than that on Plot 2. This might lead one to suppose that lime had in this instance been a controlling factor. In Plot 2 the lucerne was uniformly developed, but the growth somewhat stunted. On Plot 3 the darker green colour, due to the presence of lime, was more in evidence than on Plot 2. Plot 4, which had been both limed and inoculated, while not quite as forward as Plot 1 (treated with lime, inoculation, and manure), was yet easily the second best. Plot 5, on which lime alone was employed, was distinctly inferior to Plot 4, but much better than Plots 6 and 7, on which manure alone and inoculation alone had been respectively employed. No. 8, the control plot, was easily the worst plot on the field.

Distinctions were so pronounced on these plots that it took no verbal argument to convince those present at the demonstration of the combined efficiency of liming, inoculation, and manuring. To many New Zealand farmers these truths may be considered timeworn. It may be pointed out, however, that on the lower portions of the Wairau Plain usually little result is obtained from artificial inoculation, the lucerne bacteria being already largely present in the Blenheim soils. Again, on the papa-country of the Awatere district the relatively high lime-percentage in the soil (at Kaparu ranging from 17 to 25 per cent.) makes lucerne-growing easy. The same is true of the limestone and papa country at Ward. The sea-beaches at Kekerangu, where the salt content is not excessive, and where pulverized shells exist in abundance, also provide favourable conditions. With the last-named soils, it might be mentioned, it is a good plan to sow marram-grass to stop the sand-drifts, and then sow lucerne among the clumps of marram.

As compared with the conditions of all these latter localities those at Hillersden are comparatively very unfavourable. The soil, as already indicated, has been largely denuded, and has had much of its lime washed out and carried down on to the lower plains. Generally speaking, it may be said that lucerne is not only more difficult to grow in Hillersden, but more expensive to maintain when it is grown. Lime delivered on a Hillersden farm costs in the vicinity of £2 per ton, manure approximately 10s. per bag. If we allow for labour costs at rates current in the district an acre established on similar lines on a similar soil to that on which this co-operative stand has been grown would cost approximately from £4 10s. to £5 per acre. If the stand lasted for, say, five years, with a top-dressing of 1¼ cwt. (one bag) of first-grade superphosphate per annum, lucerne-establishment would undoubtedly pay the Hillersden farmer. This statement is, of course, subject to the modification that sufficiently small areas would have to be established to allow of their efficient treatment. It is also necessary that localities should be carefully selected. The soil on which the present stand is situated, while typical of a number of soils in the district, is not wholly typical. The fact that the soil on which the plots are situated cannot be regarded as a particularly favourable one is the more encouraging.

PASTURES.

The second series of trials, on Mr. Bishell's farm, are with various grass-mixtures, all of which were sown on 16th March, 1923.

Plot 1 is a typical temporary pasture (to last one season) consisting of 30 lb. Western Wolths rye-grass and 5 lb. cow-grass. As the plot has been down over eighteen months the Western Wolths has almost entirely disappeared. The cow-grass has remained, while a little perennial rye-grass and white clover have been introduced through stocking. Danthonia and sweet vernal, however, are beginning to take possession.

Plot 2, sown with 30 lb. perennial rye-grass and 5 lb. red clover, may be regarded as fairly typical of any flat-land pasture in the Hillersden district sown down at the same time. Already both rye and clover are showing signs of running out.

Plot 3 is a type of permanent pasture which has held well, and which has shown itself to be well adapted to Hillersden conditions. The

mixture is as follows: 15 lb. perennial rye-grass, 10 lb. cocksfoot, 3 lb. white clover, 3 lb. timothy, 2 lb. crested dogstail, 2 lb. Poa trivialis, 3 lb. meadow-foxtail, 2 lb. red clover; total, 40 lb. per acre. The most noteworthy feature of this plot was the good showing made by cocksfoot, timothy, and crested dogstail. Poa trivialis and meadow-foxtail made little or no showing. While the rainfall in the Hillersden district is fairly good (39 in. average) and well distributed, the soil does not seem to retain sufficient moisture to support these latter grasses.

Plot 4—sown with 25 lb. cocksfoot, 10 lb. perennial rye-grass, and 5 lb. timothy; total, 40 lb. per acre—is an example of a pasture in which grasses are provided for the oversward, but with the turf-forming elements omitted. It was found that white clover and cow-grass had come in through stocking, but weedy and poor patches showed plainly the need of another turf-former such as crested dogstail.

Plot 5 is sown as follows: 8 lb cocksfoot, 15 lb. Italian rye-grass, 2 lb. white clover, 3 lb. timothy, 8 lb. perennial rye-grass, 2 lb. crested dogstail, 2 lb. Poa trivialis, 2 lb. cow-grass; total, 42 lb. per acre. This is a mixture containing an excess of the temporary element—Italian rye-grass. Usually the inclusion of as much as 15 lb. of Italian would result in the smothering or at least in the partial suppression of the cocksfoot. Such, however, has not been the case on these plots. Probably the Italian rye has been instrumental in preventing the growth of much danthonia in the early stages of the pasture's establishment.

Plot 6 was designed to illustrate the effect of including a permanent element in what would otherwise be a short-rotation pasture, as follows: 25 lb. to 30 lb. perennial rye-grass, 5 lb. cocksfoot, and 6 lb. red clover per acre. This plot is quite a good one—in fact, only slightly inferior to No. 3.

The Plot 7 mixture was designed to show the effect of the inclusion of an excess of crested dogstail. In this instance the heavy sowing of crested dogstail has proved beneficial rather than injurious. The grasses sown were as follows: 10 lb. perennial rye-grass, 8 lb. cocksfoot, 8 lb. crested dogstail, 3 lb. white clover, 3 lb. timothy, 2 lb. Poa trivialis, 3 lb. meadow-foxtail, 2 lb. red clover; total, 39 lb. per acre.

Plot 8 served to show the effect of the inclusion of danthonia, the mixture being as follows: 15 lb. perennial rye-grass, 10 lb. cocksfoot, 2 lb. crested dogstail, 3 lb. white clover, 3 lb. Danthonia pilosa, 2 lb. Poa trivialis, 3 lb. meadow-foxtail, 2 lb. red clover; total, 40 lb. per acre. Danthonia is now coming in much more rapidly in this plot than is the case with those mixtures in which it was not included.

Plot 9 was sown with 30 lb. prairie-grass (pure) per acre. The plot has now run out almost entirely to danthonia and sweet vernal.

All these grass-plots were treated with a manurial mixture of 1 cwt. Nauru ground rock phosphate and 1 cwt. Nauru superphosphate at time of sowing. Last winter all the plots were again given a similar dressing of manure. The plots have been regularly stocked with sheep and spelled at intervals in order to follow as far as possible the actual farming practice of the district.

It may be affirmed with confidence that so far these plots have amply demonstrated the value as well as the necessity for a pasture of greater permanence than those commonly sown in the Hillersden district. Cocksfoot, timothy, and crested dogstail have all made good showings, and merit inclusion in the mixtures sown in future by local farmers.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

BARNYARD-GRASS (*PANICUM CRUS-GALLI* L.).

ESMOND ATKINSON, Biological Laboratory, Wellington.

Of the great family of grasses there are very few members that must be looked upon as serious weeds in New Zealand. As regards arable land, perhaps the most important are twitch (*Agropyron repens* (L.) Beauv.), *Poa pratensis*, and creeping-fog (*Holcus mollis* L.). While it does not rival these three grasses as a weed, barnyard-grass—judging by the number of specimens that are every year received for identification at the Biological Laboratory—always arouses a great deal of interest wherever it is found. For this reason, therefore, a short account of the plant is included in this series of articles.

DESCRIPTION.

The name *Panicum Crus-galli* L. (syn. *Echinochloa Crus-galli* (L.) Beauv.) includes a number of closely allied races differing from one another in various ways, but sufficiently alike to justify—for all practical purposes—their being grouped under one name. The following description is purposely made general enough to cover all the forms that are likely to be met with in New Zealand. Barnyard-grass is an annual allied to the millets, with culms* from 2 ft. to 5 ft. high, which often branch near the base and may be more or less decumbent there. The culms are sometimes quite slender, but are not infrequently as thick as those of a cereal. The leaf-sheaths (basal parts of the leaves which inclose the stem) are smooth and hairless. The blades are also without hairs, but are sometimes rough on their edges; they range from $\frac{1}{4}$ in. to 1 in. in width and from a few inches to 1 ft. or more in length. As a rule they spread rather widely from the culms, and this characteristic, together with their comparatively great width in proportion to their length, helps to distinguish the grass from most other common ones in New Zealand. The photograph (Fig. 1) shows these features quite plainly, but it should be pointed out that it was taken from a patch of the grass that had been eaten back and had made a quantity of second growth. Early in the season the plant is much taller and more upright, as well as being heavier in the seed-heads and culms.

No one who has looked at all closely at any of the common grasses in New Zealand can have failed to notice a small (often very small) whitish or semi-transparent projection at the junction of the blade of the leaf and its sheath. This structure, which is called the ligule, is often of great assistance in identifying the grass. In barnyard-grass there is a white strip at the junction of the blade and sheath, but the ligule is entirely lacking (see Fig. 2, *f*), its absence affording a rough-and-ready way of distinguishing the grass when it is out of flower.

* The name given to the jointed hollow stems of grasses.

FIG. 1. PATCH OF BARNYARD-GRASS THAT HAS BEEN EATEN BACK AND IS SHOWING SECOND GROWTH.

The "seed-head" of barnyard-grass consists of from four to fifteen or more one-sided branches which are given off at intervals from the uppermost few inches. The upper branches lie more or less closely against the culm, while the lower ones spread more widely. The latter are up to about 2 in. in length; those farther up are shorter (see Fig. 2, *d*). By the expression "one-sided branches" is meant that the flowers or "seeds" are borne in rows (in this case in three or four rows) on one side of the axis, the other side being clearly visible throughout its length. A glance at the drawing (Fig 2, *e*) will make this description clearer, and will also show that long bristles project at intervals from the axis of the branch. The branches of the seed-head are not unlike those of paspalum, and in the north barnyard-grass is sometimes known as "bastard paspalum."

The final clusters of flowers in a grass are called spikelets, each of which contains one or more flowers. In barnyard-grass each spikelet contains only a single flower and consequently only a single "seed." The drawing (Fig. 2, *b*, left) shows the structure of this spikelet, which need not be further described. It will be noticed that one of the boat-like coverings of the "seed" is tipped with a long bristle, which is called an awn. Fig. 2, *b* was made from a form of the grass with long awns, while in *a*, *d*, and *e* they are very short. This great range in the length of the awns produces correspondingly great differences in the appearance of the seed-head, and is very confusing to any one trying to identify the grass. It is quite a common thing, however, to find the awns almost lacking in second-growth seed-heads, while those borne by the same plant earlier in the season were bristling with them.

It should be mentioned here that some forms, especially early in the season, have the whole seed-head strongly tinged with purple, while others are quite pale in colour.

FIG. 2. BARNYARD-GRASS (PANICUM CRUS-GALLI L.).

(*a*), (*c*), and (*d*) "Seed-heads," leaves, culms, &c., about half natural size; (*f*) junction of leaf-blade and sheath, natural size; (*b*) details of spikelet, enlarged; (*e*) branch of "seed-head," enlarged.

DISTRIBUTION AND POSITION AS A WEED.

Barnyard-grass is widely distributed in New Zealand as a weed of roadsides, gardens, and cultivated ground generally. It is commonest in the north, becoming much less abundant in the colder parts. Specimens, however, have been received this year from Westport and Timaru, and it may quite possibly occur still farther south. Outside New Zealand the grass is found—in one form or another—in nearly all warm countries and in many temperate ones as well. In some countries certain forms are considered valuable forage plants, while others are grown for the seed, which is used as a food. Among the useful forms Japanese millet is the best known in New Zealand, as it is often and increasingly cultivated here. Other names for the more weedy forms are cockspur-grass and water-grass.

In this country the plant is essentially a summer annual, disappearing during the winter. In a hot season it often makes its appearance in extreme abundance, and may then be a really troublesome weed of cultivated crops chiefly owing to its large size and rank habit of growth, though fortunately it succumbs readily to ordinary cultivation methods. It must be remembered that barnyard-grass ripens large quantities of seed, and that it is this factor alone that determines its reappearance in the next season, so that the early destruction of the plants is of the first importance in the control of the weed. It is often said that barnyard-grass is greedily eaten by stock, and this is quite true; but wherever the weedy form grows, Japanese millet—a greatly superior forage plant—will flourish and should be used in preference.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives particulars for all cows which received certificates during November, 1924. A number of excellent performances are recorded, including several 700 lb. and 800 lb. butterfat-yields, but no class-leaderships are affected.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Jersey Brae Favourite	A. E. Watkin, Takanini ..	2 8	241·3	365	11,384·1	630·83
Ngahiwi Romance ..	W. J. Freeth, Waitara ..	1 329	240·5	365	10,575·2	622·21
Alfalfa Lassie ..	F. J. Saxby, Hamilton ..	1 357	240·5	365	8,899·3	539·10
Woodlands Countess	H. C. Sampson, Hillsborough	2 0	240·5	363	8,836·3	531·32
Clemora's Clematis†	W. T. Williams, Pukehou ..	1 363	240·5	365	11,613·5	527·05
Woodlands Bright Jewel	H. C. Sampson, Hillsborough	1 309	240·5	365	8,217·9	524·94

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Silverstream Choice Fox	G. B. Hull, Wellington ..	1 362	240·5	365	9,641·6	483·53
Oaklands Lady Brampton	F. W. Cornwall, Bell Block	1 354	240·5	329	8,093·0	478·78
Jersey Park Flower ..	W. Pollock, Hawera ..	1 339	240·5	357	8,079·9	475·46
Jersey Park Little Prim	W. Pollock, Hawera ..	1 247	240·5	365	7,946·3	475·27
Ivondale Baroness ..	P. J. Petersen, Brixton ..	1 264	240·5	365	10,733·2	473·77
Ngahiwi's Merry Queen	W. J. Freeth, Waitara ..	1 363	240·5	349	8,319·5	467·85
Meadowvale Refinement	E. O'Sullivan and Sons, Tariki	1 361	240·5	365	7,721·4	465·50
Woodlands Daphne ..	H. C. Sampson, Hillsborough	1 227	240·5	365	7,530·6	464·28
Royal Oak Silvery ..	A. J. Hale, Hillsborough ..	1 296	240·5	365	8,076·0	461·99
Favourita's Princess..	A. N. Haylock, Stratford ..	2 33	243·8	365	8,399·7	460·34
Beechland's Playful ..	A. Moreland and Sons, Te Rapa	1 322	240·5	365	8,618·1	446·81
Ngahiwi Miss Demure	W. J. Freeth, Waitara ..	2 3	240·8	341	8,366·6	445·55
Hillview Mrytle ..	W. R. Shattock, Te Rapa ..	2 29	243·4	365	8,010·0	443·03
Grasmere Wairoa ..	H. J. Berry, Kaupokonui ..	2 0	240·5	365	7,542·2	441·97
Kuranui Kate ..	O. Glynn, Morrinsville ..	1 315	240·5	365	7,650·7	437·20
Mayfield's Lady ..	R. J. W. Hancock, Brixton	1 345	240·5	365	6,992·2	431·62
Royal Oak Rosalie ..	A. J. Hale, Hillsborough ..	1 291	240·5	365	7,261·9	428·14
Meadowvale Peggy O'Neil	E. O'Sullivan and Sons, Tariki	1 355	240·5	360	6,892·7	427·15
Dainty Victress ..	W. McKenzie, Palmerston North	2 35	244·0	365	7,689·9	422·80
Rose of Blythburn ..	D. Wishart, Ryal Bush ..	1 296	240·5	332	7,354·0	419·08
Grasmere Heroine ..	H. J. Berry, Kaupokonui ..	2 13	241·8	365	7,420·2	416·80
Meadowvale La Sultane	E. O'Sullivan and Sons, Tariki	2 55	246·0	350	6,951·3	411·24
Meadowvale Melody..	E. O'Sullivan and Sons, Tariki	2 0	240·5	334	8,197·9	405·18
Hawkesbury Golden Lily	R. C. Jury, Tikorangi ..	1 337	240·5	365	6,788·6	403·74
Burnside Duchess ..	S. J. Hollard, Rowan ..	2 24	242·9	361	6,922·0	400·69
Mayfield's Queen ..	R. J. W. Hancock, Brixton	1 283	240·5	365	7,569·1	399·66
Pinewood's Berry ..	G. H. Bell, Oakura ..	1 361	240·5	365	6,977·8	397·90
Distinction's Laurino	W. R. Shattock, Te Rapa ..	2 25	243·0	360	7,326·6	377·19
Burnside Primula ..	S. J. Hollard, Rowan ..	1 362	240·5	359	6,220·0	366·39
Gowanbrae Tulip ..	O. C. Sutton Richmond ..	2 13	241·8	355	6,711·7	361·44
Holly Oak Trixie ..	Aickin and McCarroll, Woodhill	1 345	240·5	365	6,338·3	357·00
Kaiwhare Lola ..	N. V. Cederman, Richmond	1 331	240·5	365	6,992·1	348·72
Springlea Tawa Leaf	W. H. Hall, Carterton ..	2 31	243·6	365	7,197·3	334·13
Edgarley's Joy ..	T. A. Millear, Tuakau ..	1 187	240·5	365	5,575·3	297·57
Hill View Fay ..	Aickin and McCarroll, Woodhill	2 20	242·5	296	5,585·1	268·52
Taumata Park Star Queen	W. D. Knowles, Whenuakura	2 35	244·0	254	4,656·7	260·77
Senior Two-year-old.						
Meadowvale Perfect Day	E. O'Sullivan and Sons, Tariki	2 346	275·1	364	9,284·9	611·96
Beechlands Valeta ..	A. Moreland and Son, Te Rapa	2 363	276·8	364	8,736·8	524·86
Helen Douglas ..	S. R. Lancaster, Palmerston North	2 349	275·4	365	8,656·5	452·01

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Senior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Roslyn Sweet Juno	A. J. Harris, Bombay	2 294	269·9	365	8,011·4	444·00
Silverdale Melba	G. Hodgson, Whakapara	2 354	275·9	365	8,436·5	441·68
Hillview Norma	W. R. Shattock, Te Rapa	2 268	267·3	365	8,310·9	429·92
Rewa Meremal	W. H. Booth, Carterton	2 341	274·6	364	8,252·2	424·50
Basca's Baby	R. Waterhouse, Ardmore	2 274	267·9	365	6,390·7	417·65
Three-year-old.						
Waipiko Claribel	C. G. C. Dermer, Waipiko	3 231	300·1	365	13,567·6	613·20
Waipiko Lorna	C. G. C. Dermer, Waipiko	3 337	310·7	365	11,666·1	598·64
Rewa Meriton	W. H. Booth, Carterton	3 19	278·9	365	10,471·1	541·34
Jersey Brae's Royal Princess	A. H. Retter, Kaipaki	3 284	305·4	365	9,089·3	534·50
Erindale Beauty's Trix	T. H. Broomfield, Kaponga	3 334	310·4	365	9,444·2	517·35
Rewa Merrifan	W. H. Booth, Carterton	3 20	279·0	365	10,044·3	493·24
Maisonette	E. L. Mason, New Plymouth	3 48	281·8	365	7,704·6	481·58
Beachlands La Rinka	A. Moreland and Sons, Te Rapa	3 70	284·0	365	7,850·8	461·74
Belvedere Olga	J. A. Pettigrew, Pihama	3 30	280·0	343	7,564·9	429·22
Verbena's Blossom	A. Mouldey, Tirau	3 271	304·1	365	6,452·3	423·94
Jersey Bank Clematis	R. C. Jury, Tikorangi	3 339	310·9	282	8,124·4	359·99
Twilight's Milkmaid	E. T. Burke, Otakeho	3 14	278·4	350	7,308·3	352·56
Maori Humbug	H. B. Lepper, Lepperton	3 350	312·0	303	6,740·2	314·55
Four-year-old.						
Verbena's Belle	A. Mouldey, Tirau	4 349	348·4	365	9,691·7	591·98
Rapa's Silver Queen	W. McKenzie, Palmerston N.	4 229	336·4	348	11,538·1	566·26
Fancy Maid	A. J. Miller, Uruti	4 137	327·2	335	7,722·1	498·20
Woodstock's Mayfield	Mrs. A. Banks and Son, Kiwitea	4 99	323·4	365	8,789·9	486·43
Hawkesbury Carnation	C. A. Willis, Pukekohe	4 334	346·9	365	9,815·2	471·00
Charming Fancy	G. Buchanan, Paeroa	4 53	318·8	365	8,076·0	463·17
Trewithen's Sylvia	J. Klenner, Kaimata	4 17	315·2	342	7,804·3	446·14
Te Rapa Lad's Perfection	T. Church, Te Rapa	4 305	344·0	330	7,602·6	354·26
Mature.						
Jewel's Mystery	A. E. Watkin, Takanini	10 299	350·0	339	12,598·8	814·56
Fancy's Pet	A. E. Watkin, Takanini	6 339	350·0	365	16,026·7	805·00
Jersey Meadows Iris*	H. H. Phillips, Te Rehunga	5 41	350·0	365	13,472·2	804·04
Stella of O.K.	G. H. Bell, Oakura	7 60	350·0	365	12,731·5	750·40
Lady Prim	A. J. Smith, Cardiff	6 238	350·0	365	12,496·6	711·53
Fern Grove Irene	W. J. Freeth, Waitara	7 7	350·0	348	11,817·6	659·91
Glenmore Flower	A. C. Lovelock, Woodville	6 64	350·0	365	11,488·9	632·99
Facey	W. Oxenham, Uruti	6 362	350·0	358	11,872·2	626·61
Trelawny Clematis	T. Church, Te Rapa	8 5	350·0	345	13,161·7	607·85
General's Favourita	A. N. Haylock, Stratford	9 305	350·0	336	9,838·2	604·10
Jenny's Lass	A. Mouldey, Tirau	5 31	350·0	349	11,691·3	586·00
Beauty's Pet	R. C. Jury, Tikorangi	13 110	350·0	365	9,887·2	580·92
Molly Bawn	T. Church, Te Rapa	10 36	350·0	365	12,861·9	578·84
Woodstock's Bright Eye	W. E. Thomas, Aorangi	6 4	350·0	365	8,992·7	563·31
Jersey Brae's Seaweed	T. Church, Te Rapa	5 305	350·0	365	9,990·2	560·19
Elza of O.K.	G. H. Bell, Oakura	5 364	350·0	364	10,960·3	552·84
Fernaig Tiny	C. Shaw, Bombay	7 305	350·0	365	9,619·1	552·69
Neat Owlette	S. R. Lancaster, Palmerston North	6 31	350·0	365	9,302·0	540·55
Jersey Brae Flower	T. Church, Te Rapa	7 301	350·0	365	8,975·2	531·37

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat
JERSEYS—*continued.*						
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Woodlands Princess	T. A. Millear, Tuakau ..	8 78	350·0	365	8,021·1	521·48
Bonny Jess of O.K. ..	W. J. Freeth, Waitara ..	6 270	350·0	291	9,050·8	502·72
Takapu Lassie ..	R. C. Jury, Tikorangi ..	7 363	350·0	351	9,895·5	502·32
Jersey Park's Jean ..	W. Pollock, Hawera ..	5 360	350·0	342	9,440·3	501·64
Royal Oak Sybil ..	J. P. Boland, Taupaki ..	6 12	350·0	365	9,040·6	500·29
Maori Dusky ..	H. B. Lepper, Lepperton ..	6 359	350·0	365	9,378·3	478·88
Hillcrest's Liberty ..	J. P. Boland, Taupaki ..	8 19	350·0	365	8,184·9	473·69
Fascination (7787) ..	G. Buchanan, Paeroa ..	5 228	350·0	352	8,904·7	472·29
Pencarrow's Triangle Queen	W. R. Shattock, Te Rapa ..	6 215	350·0	359	7,308·1	471·19
Beachlands Sweetheart	A. Moreland and Sons, Te Rapa	6 14	350·0	321	9,920·9	456·44
Lovely Irene† ..	T. H. Wells, Awakino Point	6 71	350·0	297	7,832·2	450·11
Edgarley's Grace ..	T. A. Millear, Tuakau ..	5 38	350·0	364	6,367·2	424·18
Edgarley's Countess	T. A. Millear, Tuakau ..	5 340	350·0	365	6,699·5	407·94
Vanity's Pet ..	W. R. Shattock, Te Rapa ..	8 196	350·0	335	6,929·4	394·28
Charm's Lilac ..	G. Buchanan, Paeroa ..	5 8	350·0	348	8,332·1	385·88
Pencarrow's Tiresome	A. E. Watkin, Takanini ..	10 360	350·0	194	8,074·1	375·21
Lady Lily	N. V. Cederman, Richmond	5 8	350·0	364	7,399·6	364·53
Rewa Anchusa ..	H. H. Sutton and Co., Masterton	12 45	350·0	224	7,981·9	355·29
Lady Goldstream ..	T. Church, Te Rapa ..	6 325	350·0	218	7,187·8	351·78
Hawkesbury Snow Lily	J. W. Topham, Temuka ..	5 363	350·0	344	6,651·1	350·55
FRIESIANS.						
Junior Two-year-old.						
Coldstream Pontiac Piebe*	G. A. Marchant and Sons, Cardiff	1 320	240·5	365	16,456·6	635·95
Paeora Wild Rose Pauline*	A. S. Elworthy, Timaru ..	2 24	242·9	365	11,868·4	422·81
Mabel Johanna Canary*	John Court (Ltd.), Auckland	2 22	242·7	323	11,488·1	370·58
Senior Two-year-old.						
Westmere Pietje Rozine*	G. A. Marchant and Sons, Cardiff	2 259	266·4	365	19,508·7	703·21
Colantha Posch of Oakview*	H. R. Green, Kairanga ..	2 277	268·2	287	12,194·7	477·86
Westmere Princess Elonora	Brown Bros., Matatoki ..	2 203	260·8	365	11,427·1	414·13
Papakura Betty ..	B. M. Irvine, Auckland ..	2 310	271·5	291	7,583·3	276·97
Pareora Mentor Lass*	A. S. Elworthy, Timaru ..	3 116	298·6	340	13,608·7	489·53
Weston Lea Diamond*	E. F. Peacocke, Hamilton ..	3 26	279·6	365	15,300·6	480·15
Princess Johanna Mercedes*	John Court (Ltd.), Auckland	3 77	284·7	305	13,687·4	433·47
May Pontiac Mooie* ..	John Court (Ltd.), Auckland	3 82	285·2	314	12,645·7	399·96
Senior Three-year-old.						
Tokaora Queen* ..	R. H. Hammond, Ohakune	3 359	312·9	365	19,475·2	581·32
Senior Four-year-old.						
Clevedon Gay Lassie	B. M. Irvine, Auckland ..	4 307	344·2	311	9,861·4	361·50
Clevedon Buttercup	B. M. Irvine, Auckland ..	4 335	347·0	295	9,692·4	356·21
Mature.						
Lakeview Lotta* ..	H. R. Green, Kairanga ..	7 315	350·0	365	21,556·4	728·07
La Polka of Oakview*	H. R. Green, Kairanga ..	5 316	350·0	365	17,013·6	663·58
Tinie Grant 3rd* ..	John Court (Ltd.), Auckland	7 52	350·0	340	19,652·7	619·19

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS —*continued.*				
Mature— continued.		Yrs. dys.	lb.		lb.	lb.
Rosevale Burkeyje Sylvia*	H. North and Sons, Omimi	5 326	350·0	365	15,120·9	574·39
May Pontiac Pietertje 5th*	John Court (Ltd.), Auckland	6 63	350·0	321	18,030·0	530·95
Maid of Leith de Kol*	John Court (Ltd.), Auckland	6 48	350·0	340	14,942·2	521·99
Heather Girl of Lakeside*	R. R. Pearson, Rongotea ..	10 337	350·0	340	16,137·7	504·28
Carlowrie Belle* ..	R. K. Macdonald, Edendale	5 61	350·0	285	14,991·5	483·46
	MILKING SHORTHORNS.					
Senior Two-year-old.						
Matangi Pauline 2nd†	Ranstead Bros., Matangi ..	2 300	270·5	360	7,732·3	304·53
Junior Three-year-old.						
Cloverlea Fillpail 2nd	D. Buick, Palmerston North	3 43	281·3	365	13,768·9	547·11
Braeside Red Plume 2nd†	P. J. McLeod, Te Pua ..	3 126	289·6	331	8,117·7	346·29
Junior Four-year-old.						
Sherwood Solution† ..	Ranstead Bros., Matangi ..	4 94	322·9	365	11,021·8	415·68
Mature.						
Studleigh Nancy Lee	D. Buick, Palmerston North	9 353	350·0	365	16,142·8	620·85
Riverdale Florrie† ..	T. W. Wardlaw, Waimana	Mature	350·0	315	12,665·6	606·69
Eleam Lady† ..	Hanson Bros., Parakai ..	8 41	350·0	365	12,439·1	555·28
Sunnymead Molly† ..	Hanson Bros., Parakai ..	11–12 yrs.	350·0	356	14,026·8	541·61
Riverdale Lady† ..	T. W. Wardlaw, Waimana	Mature	350·0	315	13,982·4	502·57
Riverdale Grace 2nd†	T. W. Wardlaw, Waimana	Mature	350·0	300	11,964·1	415·87
	AYRSHIRES.					
Two-year-old.						
Sprightley of Carmel Glen	A. W. Foulds, Kumeu ..	2 6	241·1	343	8,540·1	373·11
Mature.						
Pearl II of Edendale	W. Hall, Lepperton ..	8 18	350·0	365	11,300·2	490·24
Kate of Edendale ..	W. Hall, Lepperton ..	6 28	350·0	348	10,168·6	429·45

Second-class Certificates.

	JERSEYS.					
Junior Two-year-old.						
Baby of Blythburn ..	D. Wishart, Ryal Bush ..	1 231	240·5	365	8,359·5	465·56
Bridge View Dolly ..	A. L. Hooper, Mahoe ..	1 333	240·5	348	7,343·9	455·08
Four-year-old.						
Jersey Meadows Sunday	H. H. Phillips, Te Rehunga	4 322	345·7	365	11,428·5	611·29
Mature.						
La Frescia	F. J. Saxby, Hamilton ..	5 338	350·0	365	9,896·8	573·94
	FRIESIANS.					
Junior Two-year-old.						
Glen Iris Countess Ena*	R. R. Pearson, Rongotea	1 351	240·5	365	14,102·8	526·39
Friens Mercedes Piebe†	D. Dickie, Wellington ..	2 149	255·4	365	9,840·6	352·77
	MILKING SHORTHORNS.					
Senior Two-year-old.						
Waitangi Camelia 2nd	A. J. McGovern, Kiokio ..	2 252	265·7	365	9,444·4	355·86

SEASONAL NOTES.

THE FARM.

CEREAL HARVEST.

THE grain harvest usually follows quickly on haymaking. For threshing it is generally recognized that both wheat and oats are better cut on the green side than allowed to become overripe. The latter condition involves much risk, and heavy loss may occur from a wind-shake; furthermore the sample of grain is brighter and better in quality when the crop is not allowed to become overripe. Barley, for malting, however, should not be reaped until quite ripe. The proper time to reap wheat is when the straw immediately below the head becomes yellow, and is free from moisture when tightly twisted, with the grains still a little soft but not milky or doughy. At this stage the skin or bran is finer, and the grain yields a higher proportion of flour to bran and pollard, while if the crop is left to become over-ripe both the latter increase in proportion. On the other hand, care must be observed not to cut too green, otherwise there will be a loss of weight by shrivelling. A certain amount of filling occurs after the grain is in stook.

The size of the sheaves should be regulated to suit the climatic condition and the condition of the crop. If the weather is damp the sheaves should be tied smaller to facilitate drying. Again, should there be an undergrowth of grass or weeds in the butts of the sheaves they should be made small for the same reason, and if very bad they are better left lying a day or two before stooking. This is especially important when dealing with barley with much undergrowth, as this grain is so easily discoloured, which greatly reduces its value for malting.

It always pays to take some pains in making a good stook. The average stook should consist of from eight to ten sheaves, each sheaf being firmly placed with sufficient slant to withstand a reasonable wind and turn a fair amount of rain. Considerable loss often occurs from careless stooking, the grain becoming discoloured or even sprouting when the stook falls and is left lying.

After the crop has been in stook for two or three weeks, according to weather (and if threshing from stook is not practised), stacking will follow. For this a convenient site on high ground should be selected, and a bottom made up of old logs, branches, or hedge-clippings. If the stack is to stand for some time before chaffing or threshing it is imperative that the foundation be good. The size of the stack naturally depends on the bulk of the crop and area of the field. The building commences by forming a stook in the centre and working round in tiers or courses to the marked boundary, keeping the sheaves as upright as possible. The secret of good stack-building is to build the heart firm and always higher than the outside courses from foundation to ridge. Too many stacks of both hay and sheaves are only well built on the outside courses, while the inner ones are loosely or carelessly

placed, the consequence being that later, as the whole bulk settles down, the heart sinks most, leaving the sheaves slanting downwards towards the centre, and ready to convey moisture to the heart, whereas the opposite should be the aim. The skilful builder will slightly spring the stack from the foundation to the eave. This allows the rain to drip clear, and with a well-built heart kept high, causing a slant from the centre to the outside, water will not penetrate. The novice should endeavour to see his first stack opened up, so that he may profit from any mistakes.

ROOT CROPS AND GREEN FORAGES.

The end of the year will see most of the root crops sown, the exceptions being swedes on the higher country. These may be sown any time up to the middle of January. After this it is safer to sow turnips —Hardy or Imperial Green Globe for preference—and after the end of January stubble sowing will be best. When seeding at this time of the year care should be taken to work the land down fine and roll firm so as to ensure moisture for the young seedlings.

The thinning of mangold and carrot crops should be pushed along. If mangolds are holding and looking at all yellow a top-dressing with 1 cwt. of nitrate of soda per acre will often put new life into the crop, provided that there is sufficient rain to melt the nitrate.

In districts with suitable climatic conditions misses among the mangold and turnip crops may be filled up with cattle-marrows (kumi-kumis). The best method is to plant groups of two seeds each about 3 ft. apart, using a hoe and working in a little super and blood-and-bone at the same time.

Soft turnips for dairy cows should be fed sparingly, both to avoid taint and to make the crop last as long as possible. The larger roots should be pulled first. Purple-tops are the first of all varieties to lose their succulence and to decay; they should therefore be used early, but in strict moderation, as they are most liable to injure the quality of the milk or cream. Red Paragon, Green Globe, and Devonshire Greystone are all better keepers and safer feed. No progressive dairy-farmer should allow his cows to have access to the turnip-paddock even for short periods. It is best to pull the turnips a couple of days ahead and allow them to wilt before feeding.

Millet should be grazed when not more than 10 in. high, and spelled at intervals. The best plan is to let the cows graze it for an hour or two after milking.

FIELD PEAS AND BEANS.

On rich land in a damp season it is somewhat difficult to judge just when to cut the pea crop, as in some cases the bottom pods may be overripe and shelling while the tips of the haulms are still flowering, with pods in various stages in between. In such cases mowing should be done when the greatest number of pods commence to shrivel and before they open. The cut material should be cocked in small heaps like hay, and handled as gently as possible. If the crop is badly laid the hay-rake may be used instead of a mower. Threshing can be done direct from the paddock if the weather permits.

As a rule the bean crop is not ready until after the cereals are cut. The pods should be black and the stems turning dark before reaping.

SPECIAL HAY CROPS.

In the south the late hay crops consisting of oats and pea mixtures will be ready to cut during January. The proper stage for harvesting these crops is when the oats are in a tough, doughy stage, and the peas are filling the pods. The peas must not be allowed to overripen, otherwise much loss will result when the crop is harvested. As it is, a considerable proportion of peas will fall to the ground. These may be utilized by turning sheep on to the stubble. Another method of utilizing any peas which may have fallen is to run the disk cultivators over the stubble, and so allow the peas to germinate. A catch-crop very suitable for late autumn feeding will thus be obtained. The yields from the oats and pea mixtures have in the past been most satisfactory, and if saved in good condition the material makes a splendid hay or chaff for feeding in the winter along with turnips. Similar crops intended for ensilage will also be ready for operations in January.

—*Fields Division.*

THE ORCHARD.

FRUIT HARVEST.

THE season is now at hand when all energies will be devoted to the picking, grading, packing, and marketing of fruit. In order to give this portion of the work all the attention it requires, together with the spraying necessary for keeping in check the various pests and diseases, cultivation will have to be reduced to a minimum. If cultivation is carried out in a proper manner up to New Year very little will be needed during the next few months. However, if a cover-crop is contemplated a little preparation will be necessary before it is sown in February.

It should now be fairly easy to estimate the extent of the crops of both stone and pip fruits, and every endeavour made to secure a full supply of cases, if this has not already been done. During the busy season, when both stone and pip fruits are being dealt with, everything should be in readiness so as to handle the crops as expeditiously as possible.

PICKING AND PACKING.

If it is worth while to exercise care and skill in growing the fruit it is equally important to take pains at the harvest. Just when and how the fruit should be picked depends largely on the species or variety, and on the distance it has to be shipped. The closer and better the market, the riper the fruit should be when gathered. It would seem to be unnecessary to say that all fruits intended for a good market should be hand-picked, and yet it is a fact that such fruit is often shaken from the trees. After fruit is picked it is very important that it should be kept cool and away from the sun. The correct time to pick can scarcely be described in words; experience in the orchard is the best teacher.

It is impossible to carry out the packing operations in a successful manner if a convenient packing-shed is not available. Packing in

the orchard has little to recommend it, as it is not feasible to carry out this operation under adverse weather conditions.

SPRAYING.

Codlin-moth, leaf-roller caterpillar, and pear-slug will all be in evidence at this period, and trees should be sprayed with arsenate of lead—paste 1 lb., or powder ½ lb., to 30 gallons water. For powdery mildew on apples use atomic or atomized sulphur, 8–100; for black-spot on apples and pears, lime-sulphur, 1–125, or bordeaux, 3–4–50. It is a great mistake to think that one or two sprayings are sufficient to control these pests and diseases. It is necessary to repeat the applications well on into the autumn. Woolly aphis will now be working freely, and the trees should receive a dressing of Black Leaf 40, 1 pint to 100 gallons water, plus 3 lb. soap, the application being repeated in two weeks if necessary.

Where bud-weevil is troublesome in raspberries they should be sprayed immediately after the fruit is packed, using arsenate of lead, 2 oz. to 4 gallons water. This pest does considerable damage by eating out the buds from the new canes.

—*L. Paynter, Orchard Instructor, Christchurch.*

CITRUS-CULTURE.

Phenomenal blossoming has taken place in most orange-groves and in the majority of lemon-orchards. The blossoming, however, is rather later than usual this season, doubtless owing to the wet weather experienced. Growers will therefore have to time their bordeaux application for the control of fungoid diseases accordingly, bearing in mind that the most opportune time to make the necessary application is when the majority of the blossoms have dropped from the petals. It can be anticipated that the humid conditions existing at the present time may cause such disease to give slightly more trouble than is usually the case, and, that being so, it may be necessary to make a second application of bordeaux, 4–4–40, which should be carried out some three weeks to a month after the first.

Thrip has been rather troublesome in some lemon-groves, and recently it is noticeable that Eureka and Villa Franca suffer the most in this regard. Where the red-oil emulsion, 1–40, has not been fully effective an application may be made, with benefit, of nicotine sulphate, at the rate of 1–750. Such spray will also control any black aphis that may be present.

The spray applications referred to may be considered to be the most important of the season, and, as pointed out in previous notes, the very best results are obtained by the use of a power sprayer, using spray guns. The infection of citrus-trees by either fungoid disease or insect pests is always much in evidence on the under portion of the leaves. It becomes necessary, therefore, that this portion of the trees should be very well covered with spray, and the best results are obtained in this respect as mentioned.

With regard to cultivation, the chief work will be scarifying and hoeing around the trees where necessary, the latter applying chiefly to young growing trees.

FIREBLIGHT.

Although it is a little on the early side at this juncture to state definitely that the commercial areas in the Auckland District are entirely free from fireblight infection for this season, it may now be reasonably supposed that as no infection has so far taken place in those areas there is little risk of an outbreak in regard to blossom-infection. However, it does not follow that other districts are yet entirely safe in this respect, and the strict watch which has been maintained should be continued without relaxation.

STRAWBERRIES.

Harvesting the crop is now the chief work of the commercial grower. Already large quantities have been put on the Auckland market, and the regulations for the packing of this class of fruit for sale have been brought into operation. Strawberry-growers generally in the Auckland District are to be congratulated on the manner in which they have come into line in compliance with the regulations. They will be gratified to know that retailers report increased demand by the public on account of the improvement in the pack.

—J. W. Collard, Orchard Instructor, Auckland.

POULTRY-KEEPING.

SUMMER MANAGEMENT.

JANUARY is one of the most trying months of the year, both in regard to the adult and developing stock. It is therefore a time which demands the greatest care and diligence on the part of the poultry-keeper for the birds to do their best. Especially is it necessary to give the late-hatched chickens the best possible care and attention that can be bestowed upon them if they are to make payable layers. Good shade is imperative. In addition they must receive an ample supply of good nourishing food. Green food is especially necessary at this period of the year, and cannot be oversupplied. Cleaning operations must be vigorously pursued, or vermin are almost sure to give trouble. At all costs guard against overcrowding—the common cause of young stock receiving a check in development. Do not attempt to rear weaklings or deformed stock. They should never be bothered with; better far to destroy them at the outset, and thereby save the worry of trying to rear birds which, if they come to maturity, may never pay for their keep. Again, it is the weakling which is apt to catch every passing ailment, and may thus be the means of introducing serious trouble into a flock.

I would again urge the importance of weeding out all surplus cockerels that have attained a marketable age—namely, those between four and a half and five months old. There is a great advantage in having these out of the way. Not only is there a saving in the present costly food, but the clearance also allows more space for the growing pullets, to say nothing of the saving in labour and attendance.

Broody hens should not be allowed to sit on the nest for weeks at a time. It not only means a loss in eggs, but the encouragement of vermin. Such hens should be removed to the broody-coop immediately they show a desire to sit, while the better they are fed and managed the sooner will they resume egg-laying.

IMPORTANCE OF GOOD FEEDING.

At the present time many of the birds in the average laying-flock will present a worn, thin appearance as a result of continuous heavy laying. Obviously such birds are the best layers. It is therefore imperative that they be given as much food as they will eat, in order to enable them to produce to their maximum capacity. Stupid advice is often given that it is a mistake to provide laying-birds with all the food they will take. It is now an accepted fact that the high-type layer when in a laying condition cannot be overfed with the right class of food. It stands to reason that such a small animal as our modern White Legorn, laying from six to eight times her own weight in eggs in a year, must necessarily have the material, and that of the right kind, to do it with, and then have something to maintain the great bodily vigour demanded of her.

Of course, the poor layer or the bird that has passed her best period of usefulness can easily be overfed, and they will soon declare the fact by becoming overfat. Thus, in contrast with the good layer, these low producers will exhibit a heavy and well-kept appearance, simply because while the good layer is converting her food to the manufacture of eggs the low producer turns into body flesh and fat. Obviously the latter should be culled out, for the laying-on of condition proves her to be an unprofitable layer of eggs. The only really payable bird is the one which gives up her life to egg-manufacture, and she must be encouraged in every way (especially by good feeding) if she is to make a thorough success of the business. Good feeding does not mean a feast one day and a famine the next; it means regular and liberal feeding of sound grain material, animal food, and green-stuff, while sharp gravel grit and crushed oyster-shell should be in reach of the birds at all times.

A CHICKEN TROUBLE.

Many complaints have reached me of late regarding a trouble affecting chickens after being removed from the brooder to the colony house, or before the young birds have commenced to perch. The first symptom observed is a dark greenish colour surrounding the hock joints and under the wings. Later the neck and head swell, and from then on the body gradually becomes discoloured and in a more or less moist condition. At this stage death is usually not far off.

When this trouble makes its appearance it is usually looked upon by poultry-keepers as some mysterious disease over which they have no control; but this is not so. In all cases where I have been called upon to advise its cause has been solely traced to mismanagement, either by overcrowding the chickens or compelling them to sleep in damp or badly ventilated quarters. The trouble is most common where the floor of the house is on a level with or, worse still, below the ground-surface surrounding it, as obviously such a house cannot

be maintained in a thoroughly dry condition. The foundation or wall plate of a poultry-house should be at least 6 in. to 8 in. above ground-level, and the inside filled up with well-rammed earth. This will aid in keeping the house dry, a condition which is imperative for the welfare of the growing chickens. Another cause of the trouble is bedding the chickens with hay, which heats and brings on a sweated condition. Hay may certainly be used to advantage as bedding-material in a heated brooder, because it is there prevented from becoming damp, but in a fireless brooder or a colony coop or house it should never be used, otherwise trouble may be expected at any time. Straw, straw chaff, sand, or dry earth is always to be preferred.

There is no cure for the trouble referred to ; prevention is the one and only way. The essentials for prevention are avoidance of overcrowding, provision of ample ventilation, keeping the quarters clean and dry, and checking anything likely to create a moist atmosphere. In addition, encouragement of the birds to perch at an early age is always a safeguard against the trouble making its appearance.

In connection with early perching it may be mentioned that where a chicken is encouraged to perch at an early age the breast-bone is apt to become deformed, especially where very narrow perches are provided. On the other hand, if broad perches of, say, not less than 3 in. in width are used the number of birds affected with this trouble will be reduced to a minimum.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

QUEEN-EXCLUDERS.

THE coming month should prove the advantages to be gained by the use of excluders. In the colder districts they are of inestimable value in enabling the beekeeper to finish extracting before the hot weather has altogether departed. Generally speaking, they should only be used during the main honey-flow. All sealed brood should be raised above the excluder, and the queen confined in the brood-chamber on drawn-out combs. After a few days the brood in the super should be examined in case queen-cells have been started, as it is almost impossible to find brood-combs which do not contain a few eggs, and the bees will often raise queen-cells on brood from which the queen has been separated. The queen will continue to lay on the empty combs provided, and, as the brood in the upper story hatches, the combs will be filled with honey—a great boon to the beekeeper who does not wish to extract brood-combs. By delaying the use of excluders till the main flow has started, one of their chief disadvantages—the promotion of excessive swarming—is largely obviated, as in most localities swarming stops automatically when clover blooms freely.

EXTRACTING.

By the end of December extracting should have begun in the warmer parts of the Dominion, though farther south it may not

commence till some little time later. The utensils for handling the honey should be thoroughly cleansed and scalded, and set up in the position they will occupy during the season. Everything should be tested to see that it will stand the strain of the season's work. Extracting is such high-pressure business that there is little time to stop for repairs once it commences in earnest. The uncapping-knives should be sharpened, strainers fitted with clean cheese-cloth, brakes and belts inspected, and all machinery oiled and cleaned, so that matters may run smoothly during the few weeks that the main business of the apiary is in progress.

The honey may be extracted as soon as the combs are three-parts capped, and the operation repeated two or three times during the season. In fact, keeping the extractor running from the time the main flow sets in is perhaps the most satisfactory way of dealing with a honey crop, and is to be recommended where there is a possibility of thick honey being gathered. However, in clover districts, when the beekeeper possesses plenty of supers, the honey may be left in the hives till the end of the flow, and all the extracting done at one time. Although this ensures prime, well-ripened honey, it makes the handling of the crop very heavy work, and will give more trouble from robbers, which are always very much in evidence at the end of the season. In addition, in the colder localities heavily supered hives are apt to become chilled during the later part of the summer, and cold honey is much more difficult to extract than warm.

Once the honey leaves the hives it should be handled as cleanly and expeditiously as possible. Two or three zinc trays are a big help in disposing of drips, &c. One placed on the barrow which conveys the supers of combs to the honey-house, and another on the floor of the house to receive the supers prior to uncapping, will save much unpleasantness to clothes and feet. These trays should have small blocks or supports fastened in each corner to raise the supers a little, so that the drippings from burr combs, &c., may be drained away from the bottom edge of the supers. These trays are easily washed at the end of the day and drained dry ready for the next using. The extractor, uncapping-can, and honey-tank when not in use should be kept covered with clean washing covers, and care should be taken that all bees, flies, and other extraneous things are excluded from the honey. From the peculiar nature of honey-production it is impossible to clean utensils day by day as is done with most foodstuffs, and it is imperative that honey be prevented from coming into contact with dirt and foreign substances.

PROVISION OF SUPERS.

On no account must the beekeeper neglect to provide his swarms with storage room. If the weather is normal, from ten to fifteen days after a strong swarm is hived it should be provided with a super. Not only is this necessary in order to obtain a surplus, but if it is not done the newly created colony will probably swarm again. A swarm is most vigorous and will usually make more headway than an established colony, and therefore should be encouraged by the provision of ample room. Many beekeepers deplete their honey crops considerably by failing to realize the fact that early swarms particularly will invariably yield a large surplus in a favourable season.

VENTILATION.

Every care should be taken to provide the bees with plenty of ventilation during the height of the summer. All entrances should be enlarged to their utmost capacity, and where the bees show a tendency to excessive fanning or clustering out the hive should be raised from the bottom-board, and any obstruction such as weeds, grass, &c., should be cleared away from the entrances. Most important of all, ample room should be provided by means of supers, as the overcrowding of the hive will tend to make the bees loaf if it does not produce excessive swarming.

FOUL-BROOD.

As soon as settled weather sets in, the beekeeper should carefully examine his hives for disease, and, if necessary, treat as soon as possible, so as to give his bees a chance to gather a surplus from the main flow. On no account should the operation be delayed until the bees are bringing in large quantities of the nectar that the beekeeper requires for extracting. The "shake" or McEvoy method is the only one advocated, and the combs and frames should be treated and disposed of as soon as possible after the hives are dealt with.

QUEEN-RAISING.

The beekeeper should devote all the time he can spare to the important work of replacing old and failing queens, and if his stocks are of good quality he should endeavour to raise as many queens as possible in his own yard. Cells built under the swarming-impulse are splendid for this purpose, and there are many ways of artificial queen-raising which are to be recommended. All the cells to be hatched should be given to nucleus hives to care for; queen-cells are seldom a success when introduced to full colonies. As soon as the young queens are mated and laying they should be placed in poor colonies, after killing the old queens, and their places filled by other ripe cells.

—E. A. Earp, Senior Apiary Instructor.

THE GARDEN.

VEGETABLE-CULTURE.

THE planting-out of the remaining winter crops—Brussels sprouts, broccoli, savoy cabbages, and kale—should now be proceeded with as soon as the plants are ready. The greatest care should be taken with this operation. Soak the beds well the day before lifting the plants. Lift the plants carefully and place them in trays for planting, keeping them in cool shade until they are wanted. Plant firmly in well-prepared land, watering them in.

It is important to lift onions, shallots, and garlic as soon as they ripen, leaving them in the sun for a few days to thoroughly ripen off. They may then be cleaned up and stored in a cool, dry, airy place. Firm, well-ripened onions are all too scarce; this valuable crop deserves more careful storage.

When lifting the early potato crop care is needed to avoid exposing the tubers to the ravages of the potato-moth, especially in a spell of dry weather. To sort and bag them before evening is the most effective way of saving them from the attentions of this night-flying insect that causes so much damage. Grade out all the small, diseased, and damaged tubers, and carefully select seed for the next crop. A dark cool store is the most suitable place for holding potatoes.

Asparagus and rhubarb beds that are at all backward should be watered well if at all dry, and fed liberally on the "little and often" principle to encourage strong growth.

A sowing of salads for autumn use and of peas for a late crop should now be made.

TOMATOES.

The outside tomato crop will now require constant attention in trimming and tying the vines. To neglect this important work, especially where the plants are close together, is to experience a great loss of crop. As soon as the fruit commences to set, the plants may be fed by applying liquid manures or broadcasting fertilizers on the surface and hoeing them in. The tomato-plant has a special liking for superphosphate.

Under glass, the harvesting of the tomato crop will be half completed. The superior-quality fruit from indoor plants usually makes it worth while to continue giving them attention till they are finished. Sometimes, however, they are neglected in favour of other work, and the house becomes close and hot and the plants badly diseased. This is a mistake; rather than neglect the plants they should be removed and burnt and not allowed to infect the house with fungus spores that occasion a great deal of work later.

SMALL FRUITS.

The berry crops will now be gathered—and, too often, the beds forgotten until winter. This is a serious oversight, as the next season's crop depends more than anything on the autumn growth. If this is clean and strong the prospects are good. In too many cases it is to the contrary, and the beds quickly go back and become unpayable and have to be replanted.

Most raspberry-gardens are more or less affected with leaf-spot, scales, and other insects. If when the crop is gathered the old bearing-canes are cut close to the ground and removed with all weak and superfluous suckers and carefully burnt, the remaining canes may be efficiently sprayed, and, with suitable cultivation, should finish the season in good condition.

Similarly, strawberry-beds, where they are being kept on for another season, should be cleaned up, the old foliage and runners being removed, the plants sprayed (and fed where necessary) and carefully cultivated during the autumn-growing weather. In this way they are regenerated, and can be expected to do well the following season. The same applies to other plants of this class.

TOBACCO.

Where the tobacco crop was planted out in good time it will now be approaching maturity. That stage is shown by a slight drooping

of the leaf and a mottling of yellow spots, commencing on the lower leaves first. When this condition develops on the middle leaves the plant should be harvested at the first opportunity. Avoid doing this shortly after a considerable fall of rain, as the leaf for a while will be thin and in poor condition. The best conditions are after and during bright sunny weather, when the leaf will be found to contain those aromatic qualities that increase its value. The method is to split the stalk to within 6 in. of the ground, and then cut it off at ground-level, leaving the plants on the ground for a while—an hour or so—till wilted. They are then threaded on the curing-sticks, spacing them about 4 in. apart, and carted to the curing-shed.

If the plants are wilted too long in a hot sun or dried quickly in the curing-shed the plant-cells are killed and the leaf loses its texture. Such tobacco when used carbonizes badly—a very common fault. The arrangement of ventilators is made with a view to controlling this development, retarding the drying-process somewhat at first until the leaf has mellowed and most of the green colour has gone out. The process is then quickened, and an endeavour made to secure an even and satisfactory colour. What happens is the development of an oxidizing agent throughout the leaf, which is responsible for the chemical changes in its constituents—changes that are completed in the further operation of fermentation. If this development is retarded too long, as it might be in cold wet weather, there is danger of fungus and bacterial troubles arising, hence the need of endeavouring to mature the plants at a period when bright warm weather may be expected.

—*W. C. Hyde, Horticulturist.*

Inspection of Imported Fruit, Plants, &c.—The Horticulture Division reports that the bulk of the consignments in 1923–24 arrived in good order and condition. The fruit inspected was practically clear of fruit-fly infection, only a small quantity being condemned on account of this pest. Fumigation was necessary, however, in connection with a number of lines found on examination to be affected with live scale and mealy bug. Several consignments of almonds badly attacked by the Indian meal-moth (*Plodia interpunctella*) had either to be reshipped or destroyed, and similar action was necessary in regard to a quantity of imported bulbs infected with bulb-mite.

Work at Wallaceville Veterinary Laboratory.—The annual report of the Live-stock Division states that during the year 1923–24, 1,522 specimens were received at the Laboratory for examination, comprising 794 milk-specimens for contagious mammitis, 155 for the biological test for tubercle bacilli, 241 blood-specimens for contagious abortion, and 119 specimens from Stock Inspectors, the remainder being of a miscellaneous pathological nature. There were also received a number of specimens connected with dairy bacteriology, concerning which work has been undertaken in conjunction with the Dairy Division. An investigation as to the cause underlying the complaint of sterility in dairy cows, now troublesome among cows in dairying districts, is in progress. Field officers' observations had narrowed the work to granular vaginitis and contagious abortion, but the *Bacillus abortus* has now been eliminated as a factor in sterility as the result of the examination of a number of blood-specimens from herds where vaginitis was prevalent. The form of sterility present therefore appears to be the result of granular vaginitis. Various methods of treatment of affected animals have been tried, but nothing better than simple astringents used in the acute stage has so far been ascertained. During the year, 71,250 doses of black-leg vaccine prepared at the Laboratory were sent out for use by officers.

CARE OF HOME-SEPARATOR CREAM.

CAUSES OF BAD CREAM.	THE REMEDIES.
1. Unhealthy cows ..	1. Don't separate the milk from a cow which has not been cleansed or is otherwise unhealthy.
2. Feed-flavours	2. Most feed-flavours can be partly removed by cooling and stirring, the exceptions being turnips, garlic, and similar flavours.
3. Dirty sheds and yards ..	3. Milk absorbs flavours from dirty surroundings. Where machines are used the air is actually admitted into the milk-pipes. Hence unclean surroundings mean bad-flavoured milk.
4. Careless milking ..	4. Teats and udders must be washed with a clean cloth and clean water from a clean bucket, and then dried before milking. Water must also be provided for washing the milker's hands.
5. Dirty milking-machines	5. Milking-machines must be treated as advised in special instructions issued by the Department.
6. Unclean utensils ..	6. Buckets, separators, &c., must be rinsed with cold water, scrubbed in warm water with a brush, cleanser to have been added to the water, then scalded with boiling water immediately after separating.
7. Washing separator once daily	7. A separator which is washed only once daily is a direct loss to the owner, as it will not skim clean the second time it is used, and will taint all the cream passing through it.
8. Skimming too thin ..	8. Skim a cream containing about 40 per cent. of fat; it will carry well, and will not quickly develop bad flavours.
9. Not cooling cream ..	9. Run the cream over a small cooler as it leaves the separator. Attach the water-inlet hose to the lower end of the cooler. Stand it in cold water afterwards.
10. Not stirring cream ..	10. Stir frequently with a metal plunger, but don't use a wooden stirrer.
11. Mixing hot and cold cream	11. Never mix hot and cold cream. Use a clean can or bucket for each skimming, and keep them separate if possible until sending to the factory.
12. Holding cream in kerosene-tins	12. Kerosene-tins are not suitable for use in a dairy unless the seam round the bottom and the lap round the top have been properly soldered.
13. Dirty and badly ventilated separator-rooms	13. The separating-room must be kept as clean as a butter-factory, and have at least two large ventilators, one at the bottom and the other at the top on opposite walls, and should not be placed near the yard. The engine must not be in this room.
14. Keeping cream too long before sending to the factory	14. Don't fail to send the cream away on the days arranged by the factory, daily if possible.
15. Leaving cream standing in the hot sun	15. Protect the cans from the sun while waiting for the collecting-wagon.
16. Rusty cans	16. Rusty cans impart a most objectionable flavour to cream. Have them retinned.

DON'T use the separating-room as a general storeroom. Don't use a cloth to wash tinware; use a brush. Don't use sandsoap for scouring tinware. Don't use a cloth strainer unless you wash and scald it daily. Don't use the cans returned from the factory until you have scalded them. Don't mistake WARM water for BOILING water.

—Dairy Division.

THE DAIRY INDUSTRY AMENDMENT ACT, 1924.

1. This Act may be cited as the Dairy Industry Amendment Act, 1924, and shall be read together with and deemed part of the Dairy Industry Act, 1908 (hereinafter referred to as the principal Act).

Validation of certain Allotments of Shares in Co-operative Dairy Companies.

2. (1.) Every allotment of additional shares to any shareholder of a co-operative dairy company heretofore made by the directors of the company shall, if made in conformity with the terms of the articles of association or of any amendment of such articles, and notwithstanding that such articles or amendment thereof may be *ultra vires* of the company, be deemed to have been validly made, and the shares so allotted shall be deemed to have been accepted by the shareholders to whom they were respectively allotted in accordance with the terms of the allotment, save that nothing herein shall apply with respect to the allotment of shares being the subject-matter of the judicial determination of the Supreme Court in the case of Macdonald *versus* The Normanby Co-operative Dairy Factory Company, Limited (reported in the *New Zealand Law Reports*, 1923, pages 123 to 148); or with respect to the allotment of shares to any shareholder who, within six months after receiving notice of such allotment, heretofore gave to the company notice in writing of his objection to receive such shares, and within the said period of six months permanently ceased to be a supplier of milk, cream, or other dairy-produce to the company. Nothing in this subsection shall be construed to authorize the allotment of any shares after the passing of this Act, or to validate any allotment made after that date, if such allotment would be invalid if this Act had not been passed.

(2.) Every person to whom the directors of any co-operative dairy company have heretofore purported to allot shares in the company, but who was not a shareholder prior to such allotment, shall be estopped from denying the validity of the allotment if, being at the date of the allotment a supplier of milk, cream, or other dairy-produce to the company, he did not within six months after receiving notice of such allotment give to the company notice in writing of his objection to receive such shares, and within the said period of six months permanently cease to be a supplier of milk, cream, or other dairy-produce to the company.

Validation of certain Articles of Association as to Supply of Dairy-produce.

(3.) The provisions in the existing articles of association of any co-operative dairy company purporting to oblige the shareholders of that company to supply milk, or cream, or other dairy-produce to the company shall be deemed to be and at all times since the making thereof to have been valid and effective, and to have imposed on the shareholders, according to the tenor of those articles, an obligation to supply such milk, cream, or other dairy-produce to the company; and any penalty prescribed by such articles for failure so to supply such milk, cream, or other dairy-produce shall be deemed to be and to have been lawfully fixed, and every shareholder who hereafter makes default in complying with the terms of the articles shall be liable accordingly:

Provided that nothing in this subsection shall apply with respect to the articles of association of the Cheddar Valley Co-operative Dairy Company, Limited, in their application, before the passing of this Act, to the appellant in the case of Shalfoon *versus* The Cheddar Valley Co-operative Dairy Company, Limited (reported in the *New Zealand Law Reports*, 1924, pages 561 to 596):

Provided also that nothing in this subsection shall be construed to authorize the inclusion, after the passing of this Act, of provisions in any articles of association purporting to oblige the shareholders of any company to supply milk, cream, or other dairy-produce to the company; and all articles of association to which this subsection applies (being articles made before the passing of this Act) shall, on the expiration of six months after the passing of this Act, cease to have any force or effect, save so far as they may be valid and effective irrespective of the provisions of this subsection.

Noxious Weeds Orders.—Broom, gorse, and variegated thistle have been declared to be noxious weeds within the County of Waipawa.

THE POULTRY ACT, 1924.

[An Act to regulate the keeping of poultry and the sale and export of poultry and eggs.]

1. This Act may be cited as the Poultry Act, 1924.

2. In this Act, if not inconsistent with the context, "Disease" means tuberculosis, roup, fowl-cholera, chicken-pox, and any other disease affecting poultry which the Governor-General from time to time, by Order in Council, declares to be a disease within the meaning of this Act. "Eggs" includes pulped or dried eggs. "Inspector" means an Inspector appointed under this Act. "Owner" includes the occupier of any premises on which poultry are kept, or are exposed for sale, or are held or stored, and also includes any person having charge of any poultry. "Poultry" means domestic fowls, ducks, geese, and turkeys, and includes the carcase of any such birds.

3. There may from time to time be appointed such Inspectors, Graders, and other officers or persons as may be required for carrying out the provisions of this Act.

4. An Inspector may at any time enter upon any land or premises or into any conveyance or ship where he has reason to believe that any poultry or any eggs intended for sale or export may be, and may there inspect for the purposes of this Act any poultry or eggs, or any buildings, equipment, or appliances used in connection with any poultry.

5. All poultry exposed for sale, or held, stored, or kept on any premises, shall be kept under sanitary conditions; and an Inspector may, by notice in writing in the form prescribed, require the owner of any poultry, within the time limited in the notice, to remedy any specified defect in such conditions, or to abandon any insanitary practice or the use of any insanitary appliance, or to remove on the grounds specified the poultry from the premises.

6. Every owner of poultry who is guilty of cruelty towards them by reason of overcrowding, or of the failure to provide adequate shelter, food, or drink, or by reason of any other act or default, commits an offence against this Act.

7. (1.) Every owner of poultry shall within twenty-four hours notify an Inspector of any outbreak of disease discovered or suspected amongst his poultry, and shall either forthwith destroy any birds which are diseased or suspected to be diseased, or, as far as practicable, isolate any such birds from other birds.

(2.) When an Inspector finds that any poultry are diseased he may, by notice in writing in the form prescribed, direct the owner of such poultry to comply with any of the following requirements: (*a*) Forthwith to destroy in the manner set out in the notice such diseased poultry and any other poultry with which they have come into contact; (*b*) not to remove for a period set out in the notice any poultry from the premises on which such diseased poultry was kept; (*c*) forthwith to take such other steps for the prevention of the spread of disease as may be set out in the notice.

(3.) If any such owner fails to take any measures or do any acts required as aforesaid, the Inspector may himself perform the same at the expense in all things of the owner, who nevertheless shall not thereby be relieved from any liability that he may have incurred under this Act by reason of his default.

(4.) Any expenses incurred by an Inspector under the last preceding subsection shall be repaid to the Inspector on demand, and in default thereof the amount of such expenses may be recovered from the owner as a debt due to the Crown.

8. No person shall knowingly sell, or offer or expose for sale, or have in his possession for sale, any poultry which is diseased.

9. For the purposes of this Act every person shall be deemed to sell any poultry or eggs who sells the same either on his own account or as the agent or servant of any other person, and in the case of any sale by an agent or servant his principal or employer shall be under the same liability as if he had effected the sale personally.

10. Every person who obstructs any Inspector or other officer in the performance of his duties, or who fails to comply with any direction given by an Inspector or with any of the provisions of this Act, or who commits any offence against this Act, shall be liable on summary conviction to a fine of twenty pounds.

11. The Governor-General may from time to time, by Order in Council, (*a*) declare any disease of poultry to be a disease within the meaning of this Act; (*b*) specify the ports from which alone poultry or eggs shall be exported; (*c*) appoint stores at which poultry or eggs shall be graded.

12. The Governor-General may from time to time, by Order in Council, make regulations for all or any of the following matters, that is to say: (*a*) Prescribing the sanitary requirements that must be observed in the keeping of poultry, or holding or storing poultry on any premises, or in the carriage of poultry; (*b*) regulating the marketing of poultry and of eggs for consumption in New Zealand, and providing for the grading and packing of such poultry and eggs; (*c*) regulating the export of poultry or of eggs, and providing for the grading and packing of poultry and of eggs for export from New Zealand; (*d*) prescribing reasonable charges for the grading of poultry or eggs or for other services rendered by officers under this Act; (*e*) prescribing forms of notice and other forms required under this Act; (*f*) generally providing for such matters as are contemplated or deemed necessary for giving full effect to this Act.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GREASY HEEL IN HORSES.

C. S. OSBORN, Rakaia:—

Will you please state what you consider the best cure for greasy heels in horses?

The Live-stock Division:—

Except in very slight cases a cure of greasy heel is very difficult to effect. The disease is primarily constitutional, and therefore internal as well as external treatment is necessary. For the former a dose of physic given occasionally is necessary. An aloes ball in a dose from 4 to 6 drams, according to the size of the horse, is the most suitable. The external treatment is as follows:—Clip all the hair from the heels and fetlocks, and liberally apply the following lotion once daily to the affected parts: Zinc sulphate, 2 oz.; Bol Armen, 1½ oz. Add this to a quart of water, and shake well before using. The materials can be obtained from a chemist. Keep the horse as much as possible out of wet places, and, if standing in the stable, keep the floor clean from urine and dung. If the horse is badly affected a cure is practically impossible, but by using the above treatment the trouble can be kept in check and the objectionable condition lessened.

CONTROL OF DODDER.

C. P. WICKSTEED, Stratford:—

In the spring of 1923 I sowed a paddock in oats and grass, cutting the oats for hay in January. I now find a parasite, which appears to be dodder (specimen enclosed), evenly distributed throughout the paddock, and have concluded it was introduced in the clover-seed when sown. Is it possible to eradicate dodder by cultivation? Would it die out if left, the pasture being grazed with dairy cows? Will dodder seed and spread over the whole farm?

The Fields Division:—

The specimen is dodder, and, as you suggest, it was probably introduced with the clover. Dodder may be eradicated by cultivation, but to effect this it is necessary to avoid growing any crop containing legumes, such as clover or lucerne, for two or three years. Dodder is not likely to die out on a pasture, so long as there is any clover left, where the grazing is done by dairy cows. Close grazing with sheep would probably help to control it. Dodder seeds and is spread by stock, the seeds passing through cattle similarly to clover.

APPLES WITH BITTER-PIT.

A. E. BOWLER, Matamata :—

We have a few apple-trees (Northern Spy, Gravenstein, Sturmer), the fruit of which was mostly spoilt by brown spots just under the skin. At first it only affected the Northern Spy; now all the fruit is about the same. Is there any spray or treatment that will cure the trees of this disease ?

The Horticulture Division :—

The brown spots just under the skin of your apples are probably due to a trouble known as bitter-pit. The spots are formed, it is supposed, by the sudden flooding and rupture of the pulp-cells, which afterwards become oxidized. The trouble is common on young and over-vigorous trees carrying but a few fruits, especially in a season when extreme wet and dry conditions are experienced. When trees settle down to moderate growth and carry a full crop, chiefly on the laterals, the trouble is generally considerably lessened.

CONTROL OF POTATO-MOTH.

A. CULLEN, Maungaturoto :—

We have had great trouble in the past to keep our potatoes from the moth. What is the best thing to do when storing potatoes through the winter ?

The Fields Division :—

This insect pest is very troublesome, and requires very careful attention to the methods used for controlling it. If you wish to keep the potatoes through the winter in storage you must begin in the field—that is, provided you are growing the potatoes yourself. The following measures are recommended : Seed infected with the pest should not be used for planting. Land where the moth was present in the previous season should not again be used for potatoes. In sowing seed plant deeply, so that the seed is well covered. Practice thorough and clean cultivation so as to cover all the tubers; in hilling this is especially necessary. Weeds, such as nightshade and other plants of the potato family, should be destroyed, as these provide breeding-places for the moth. When the moths are seen about the crop spray with arsenate of lead. When digging potatoes do not leave them exposed in the field, as this is a common means of infection; they should be stored so that the moths cannot get at them to deposit their eggs. When bagging in the field, bags should be sewn without delay. Do not put potato-tops over the bags, as the tops may contain moths or caterpillars. All dead plants and small tubers that are not required should be collected and destroyed; the tops can be burnt, while the tubers may be boiled and fed to pigs and poultry. Old sacks which held infected potatoes should be dipped in boiling water. If the potatoes are stacked during the winter in a tight room they can be fumigated. On the top of the sack place a shallow vessel, and into this put some bisulphide of carbon, and close the door tightly. This should be repeated about every ten to fourteen days. Four or five such fumigations should be sufficient. About 5 lb. of liquid bisulphide should be used for every 1,000 cubic feet of space. The gas is highly inflammable, therefore no lights of any kind should be allowed near it. In the absence of a tight room draw the potatoes into a heap, place a saucer containing carbon bisulphide on the top, and cover the whole with canvas or tarpaulin, and fumigate in this way.

PARALYTIC TROUBLE IN YOUNG PIGS.

"TROUBLE," Matamata :—

I have had a lot of deaths in young pigs from a few days old up to twelve weeks. They stagger about, and in facing the wind throw up their head and paw the air with front feet and cannot make headway. Some have a discharge from the eyes, and last year some had their eyes sealed right up. They have had a run on artichokes and pasture, and been fed with skim-milk, concentrates, &c.—all the food they can take. Can you help me, please ?

The Live-stock Division :—

The animals are probably affected with a form of paralysis, or loss of power in the limbs, which is frequently met with in young pigs. This is usually attributed to a dietetic cause—feeding on skim-milk which has been allowed to become too sour before feeding giving rise to gastritis. Another cause is to be found in cold, damp styes exposed to the prevailing winds. If this applies in your case, removal of the styes to a well-sheltered, warm place, and attention to dryness of the floor, &c., are suggested as preventive measures. The sows' feed should be looked into. It is possible that you have been overfeeding, and that the milk is proving too rich for the sucking-pigs.

SALT FOR DAIRY STOCK.

J. H. MATHEWS, South Norsewood :—

Can you tell me when is the best time to put rock salt out for stock, also if any special make of boxes is recommended for salt to be put in ?

The Live-stock Division :—

Salt in moderate quantity assists in the formation of flesh. Salt exists in a natural condition in food and water, and normally it should not be necessary to supplement it. In the case of dairy-cows, however, a good deal of the natural chlorine goes in the milking, and it is necessary to add salt to the daily ration. In the late season and in the case of winter cows, when salt is more necessary, it is better added to the feed in the form of ordinary salt. A handful once daily should be sufficient. Rock salt is apt to be wasted if fed in the paddocks, and it is better to place it in a box at the bail-head for the cows to lick during the milking.

NEW ZEALAND CROP STATISTICS; SEASON 1923-24.

Crop.	Area.	Yield per Acre.	Total Yield.
	Acres.		
Wheat—			
Grain	173,864	24·01 bushels	4,174,537 bushels.
Chaff, &c.	1,629	1·32 tons	2,146 tons.
Oats—			
Grain	63,842	30·77 bushels	1,964,511 bushels.
Chaff, &c.	326,652	1·12 tons	366,546 tons.
Barley—			
Grain	21,286	28·07 bushels	597,416 bushels.
Chaff, &c.	590	1·61 tons	976 tons.
Maize—			
Grain	8,208	49·40 bushels	405,855 bushels.
Ensilage	958	6·12 tons	5,852 tons.
Peas and beans	18,676	19·43 bushels	362,787 bushels.
Linseed—Seed	12,119	0·22 tons	2,705 tons.
Rye-grass—Seed	43,487	332·58 lb.	14,519,187 lb.
Cocksfoot—Seed	11,619	122·85 lb.	1,428,759 lb.
Chewings fescue—Seed	9,279	161·57 lb.	1,499,177 lb.
Crested dogstail—Seed	4,749	156·53 lb.	753,836 lb.
Red clover and cow-grass—Seed	5,543	143·41 lb.	1,213,835 lb.
White clover—Seed	4,161	132·77 lb.	581,676 lb.
Other grasses and clovers—Seed	2,225	146·84 lb.	326,863 lb.
Grasses and clovers cut for hay	188,979	1·67 tons	317,616 tons.
Potatoes	20,993	5·00 tons	105,552 tons.
Green fodder	239,652	..	..
Turnips	477,381	..	..
Mangolds	9,989	..	..
Onions	374	8·76 tons	3,278 tons.
Hops	701	1,374·34 lb.	963,415 lb.

WEATHER RECORDS: NOVEMBER, 1924.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather returns for November again show a higher temperature than is usual for the month. Rainfall was above the average in the Auckland, Taranaki, Nelson, and Marlborough Provinces, which was owing to two ex-tropical disturbances—one at the beginning of the month, and another culminating about the 18th. These did not account for heavy rains in other parts of the Dominion, where records show that rainfall was below the average. Westerly disturbances also passed on the 2nd, 16th, and 27th, but, except for the one about the 16th, were only of moderate intensity.

Barometric pressure was somewhat unsteady, but mostly above the normal. Many parts of the country report warm and sunny conditions, and phenomenal growth was experienced except in some parts where the rainfall was deficient.

—*D. C. Bates, Director.*

RAINFALL FOR NOVEMBER, 1924, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	1·80	8	0·48	3·27
Russell	4·10	7	2·00	1·61
Whangarei	4·01	13	1·92	3·41
Auckland	4·68	12	1·54	3·27
Hamilton	4·11	12	0·87	4·05
Kawhia	4·91	13	1·48	4·49
New Plymouth	5·20	13	1·04	4·58
Inglewood	8·93	13	3·03	8·95
Whangamomona	6·75	12	1·88	7·40
Tairua, Thames	11·00	10	2·90	3·55
Tauranga	5·09	15	1·97	3·26
Maraehako Station, Opotiki ..	5·15	13	1·32	2·78
Gisborne	2·26	12	0·50	3·15
Taupo	3·58	11	0·78	3·41
Napier	1·77	10	0·96	2·08
Maraekakaho Station, Hastings ..	0·56	11	0·11	2·03
Taihape	1·75	12	0·47	3·67
Masterton	2·32	10	0·63	2·87
Patea	3·23	11	1·09	3·72
Wanganui	2·46	6	1·03	3·31
Foxton	1·88	7	0·56	3·80
Wellington	2·93	12	0·70	3·46
	South Island.			
Westport	8·56	20	1·39	7·08
Greymouth	8·62	15	1·78	9·46
Hokitika	12·60	16	2·76	10·73
Arthur's Pass	12·47	16	2·25	15·00
Okuru, Westland	11·96	15	1·82	12·96
Collingwood	5·39	13	2·10	7·68
Nelson	6·70	14	1·25	2·87
Spring Creek, Blenheim ..	3·52	8	1·60	2·41
Tophouse	5·13	14	1·50	7·07
Hanmer Springs	4·78	8	1·87	2·91
Highfield, Waiau	4·50	8	2·42	2·52
Gore Bay	3·06	7	2·18	1·98

RAINFALL FOR NOVEMBER, 1924—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
South Island—continued.				
Christchurch	2·47	7	1·33	1·84
Timaru	1·56	9	0·46	1·97
Lambrook Station, Fairlie ..	1·50	6	0·43	2·00
Benmore Station, Omarama ..	1·98	11	0·70	2·05
Oamaru	2·05	8	1·35	1·94
Queenstown	2·34	7	1·02	2·77
Clyde	1·24	5	0·42	1·36
Dunedin	1·69	8	0·50	3·30
Gore	1·13	9	0·34	3·08
Invercargill	0·86	12	0·30	4·60

FORTHCOMING AGRICULTURAL SHOWS.

Rangitikei A. and P. Association: Taihape, 14th and 15th January.
Woodville A. and P. Association: Woodville, 20th and 21st January.
Waimarino A., P., H., and I. Association: Raetihi, 22nd January.
Tapanui Farmers' Club: Jubilee Show, Tapanui, 28th January.
Pahiatua A. and P. Association: Pahiatua, 30th January.
Maniototo A. and P. Association: Ranfurly, 6th February.
Clevedon A. and P. Association: Clevedon, 7th February.
Dannevirke A. and P. Association: Dannevirke, 11th and 12th February.
Te Puke A. and P. Association: Te Puke, 12th February.
Rodney Agricultural Society: Warkworth, 14th February.
Northern Wairoa A. and P. Association: Mititai, 17th and 18th February.
Masterton A. and P. Association: Solway, 17th and 18th February.
Te Awamutu A., P., and H. Association: Te Awamutu, 18th February.
Whakatane A. and P. Association: Taneatua, 18th February.
West Coast A. and P. Association: Greymouth, 18th and 19th February.
Rotorua A. and P. Association: Rotorua, 20th February.
Waiapu P. and I. Association: Ruatorea, 25th and 26th February.
Tauranga A. and P. Association: Tauranga, 26th February.
Opotiki A. and P. Association: Opotiki, 26th February.
Franklin A. and P. Association: Pukekohe, 27th and 28th February.
Omaha and Pakiri A. and H. Association: Leigh, 28th February.
Taumarunui A. and P. Association: Taumarunui, 4th March.
Waikato Central A. Association: Cambridge, 4th and 5th March.
Mangonui A. and P. Association: Mangonui, 6th and 7th March.
Morrinsville A., P., and H. Society: Morrinsville, 11th March.
King-country Central A. and P. Association: Te Kuiti, 12th March.
Matamata A. and P. Association: Matamata, 19th March.
Mayfield A. and P. Association: Mayfield, 21st March.
Methven A. and P. Association: Methven, 26th March.
Temuka and Geraldine A. and P. Association: Winchester, 2nd April.

Agricultural and Pastoral Association Secretaries are invited to supply dates and location of their shows for publication in this list.

Compensation for Condemned Stock.—Compensation to the amount of £12,918 was paid out during the year 1923–24 for 5,363 animals condemned in the field for disease under the Stock Act, and £13,266 for carcases or parts of carcases condemned for disease on examination at time of slaughter at abattoirs and meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act. This made the total amount for which the Consolidated Fund became liable during the year £26,189, an increase of £591 on the previous year's figures.

BONUS FOR A METHOD OF EXTERMINATING BLACKBERRY.

The following notice was issued in the *Gazette* of 27th November :—

Department of Agriculture,
Wellington, 19th November, 1924.

The New Zealand Government hereby offers, subject to the conditions stated below, a bonus of ten thousand pounds (£10,000), payable in New Zealand, for an efficient, practical, and economical method of exterminating blackberry, otherwise than by cultivation or farm-management methods such as seeding, tree-planting, or live-stock manipulation.

Applicants for the bonus must prove to the satisfaction of a Committee (to be appointed by the Minister of Agriculture) by actual trials commencing at the times, and continuing over the periods, specified by the Committee, and on areas of blackberry not less than one acre in extent to be provided for the purpose by the Government—

(1.) That the method is fully effective in exterminating blackberry at a cost not more than double that of cutting the plants down to about ground-level by hand on land similar to that on which the trials are made.

(2.) That the method does not impair the normal fertility of the soil or its capacity for producing pasture plants, or cause risk to the health of farm animals afterwards depastured upon the land where the method has been applied.

(3.) That the method is readily applicable to and effective against blackberry growing on land of all classes, including broken and steep country and land carrying rocks, stumps, and felled timber.

Applicants must state in their applications full particulars of the method they propose, including the amount of water (if any) needed per acre, also the actual cost for each of the following—namely, apparatus, materials, labour, and any other items that are needed for complete extermination of blackberry by the method submitted : the cost to be stated where practicable at per acre, and to have been ascertained by the actual treatment of an area of not less than one acre of heavily infested land that has been successfully dealt with by that method.

Applicants must also state what lump sum (excluding the bonus of £10,000) would be required to purchase the New Zealand rights of their method in the event of such rights being acquired by the New Zealand Government for free use of all occupiers of land in New Zealand ; or, if any applicant is unwilling to sell his rights, what royalty he would require for the use of his method.

Applications, giving the full name and the telegraphic and postal addresses of the applicant, must be forwarded by registered post to the Director-General, Department of Agriculture, Box 888, Wellington, New Zealand.

The bonus will be paid to the person whose application is first received by the Director-General and whose method, in the opinion of the Committee, fully complies with the above-mentioned conditions.

W. NOSWORTHY, Minister of Agriculture.

British Market for Peas and Beans.—The following report was cabled by the High Commissioner, London, on 6th December :—

Peas—Blue marrowfats : Japanese now making £24 10s. per ton c.i.f., December/January shipments, after reaching £26. Tasmanian "A" grade sold at £21 to £22 c.i.f. New Zealand ex store worth about £18 to £20. Maple : Market slow. Tasmanian spot quoted at 80s. to 87s. 6d. per 504 lb., sellers ; and February/April shipments, 72s. to 75s. Reported sales in new crops at 74s. 6d. New Zealand No. 1 partridge, slow sales spot at 70s. to 77s. 6d. Buyers indicate 65s. to 70s. new crops for shipment early next year. English maple, good supply on hand offering at 50s. to 60s. Beans : English plentiful at 53s. to 62s. per 532 lb.

LIVE-STOCK IN NEW ZEALAND, 1924.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1923–24.	Number of Lambs tailed, 1923–24.	Sheep (including Lambs) as at 30th April, 1924.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	38,181	40	487,611	174,965	22,359	621,143	279,960	683,504	58,586	1,093	1,400
Auckland	47,355	2	677,218	288,903	25,174	794,082	408,953	836,599	92,739	1,163	1,553
Gisborne	19,697	43	322,443	26,328	4,633	2,801,801	1,343,173	3,028,087	15,083	362	490
Hawke's Bay	16,855	4	259,295	46,880	7,353	2,500,676	1,251,663	2,921,594	15,563	744	363
Taranaki	21,868	..	394,407	192,220	11,340	743,502	334,251	757,777	50,541	413	4,158
Wellington	43,863	12	711,713	184,450	20,195	4,780,662	2,552,673	5,334,509	64,091	398	570
Nelson	7,930	2	66,042	25,179	4,067	349,742	129,992	397,905	12,811	896	1,013
Marlborough	7,191	4	48,831	16,371	2,473	908,634	402,855	991,412	7,816	334	2,861
Westland	2,609	..	44,891	11,016	2,415	50,879	35,401	57,646	4,323	..	66
Canterbury	62,876	30	214,360	86,816	11,918	3,792,392	2,415,079	4,453,312	52,192	167	92
Otago	35,095	10	149,402	56,071	8,673	2,484,535	1,210,583	2,857,629	24,271	9	29
Southland	26,910	1	187,284	75,778	7,012	1,249,636	768,753	1,455,802	16,255	..	22
Dominion totals ..	330,430	148	3,563,497	1,184,977	127,612	21,077,684	11,133,336	23,775,776	414,271	5,579	12,617
Totals, 1923 ..	330,818	205	3,480,694	1,124,671	123,972	20,420,119	10,895,521	23,081,439	400,889	4,338	12,733

THE SEASON'S LAMBING: DOMINION ESTIMATES.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by the Department's Inspectors of Stock in the various districts. Corresponding figures for the four previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1924 ..	7,148,949	85·00	6,049,652	..
1923 ..	7,170,154	91·34	6,549,143	6,170,673
1922 ..	6,771,482	90·36	6,118,530	5,955,081
1921 ..	6,312,456	89·65	5,659,355	5,457,643
1920 ..	5,838,704	87·95	5,135,524	5,074,751
		SOUTH ISLAND.		
1924 ..	5,927,145	87·87	5,208,378	..
1923 ..	5,892,849	83·99	4,949,313	4,962,663
1922 ..	5,724,572	82·53	4,724,475	4,949,440
1921 ..	5,835,332	83·28	4,859,425	4,810,258
1920 ..	5,729,845	80·20	4,595,426	4,539,797
		DOMINION.		
1924 ..	13,076,094	86·14	11,258,630	..
1923 ..	13,063,003	88·02	11,498,456	11,133,336
1922 ..	12,496,054	86·77	10,843,005	10,895,521
1921 ..	12,147,788	86·59	10,518,780	10,267,910
1920 ..	11,568,549	84·11	9,730,950	9,614,548

KILLINGS AT MEAT-WORKS, 1923–24.

FIGURES issued by the Meat Producers Board show the total killings at meat-works in New Zealand for the frozen-meat industry year, 1st November, 1923, to 31st October, 1924, as follows:—

Class.	North Island.	South Island.	Dominion.
Lamb (carcases)	2,108,534	2,661,049	4,769,583
Wether mutton (carcases)	874,230	145,035	1,019,265
Ewe mutton (carcases)	641,996	278,063	920,059
Beef (quarters)	321,338	1,491	322,829
Sundries (freight carcases of 60 lb.) ..	290,338	64,008	354,346

Bush-sickness and Sheep-raising.—The last annual report of the Live-stock Division states: "For a long time it has been a recognized fact that horses, pigs, and poultry can be reared upon bush-sick land without contracting the sickness that inevitably overtakes cattle and sheep. Calves can now be reared with special treatment, and adult cattle, if attacked by bush-sickness, will recover with the right treatment. In order to follow up its progressive policy the Department will now require to turn its attention to preventive and remedial measures in so far as sheep are concerned. Our past experience with cattle should prove invaluable in this connection."